# The Science Teacher

APRIL

1942

Volume IX

Number 2



**Published**
*October*
*December*
*February*
*April*

Training for Defense — see page 7

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*A National Service Journal*

# The Science Teacher

*Official Journal of*

## American Science Teachers Association

*Associated with American Association for Advancement of Science*

## And State and Regional Associations




Science teachers' organizations are invited to affiliate with the American Science Teachers Association. For information write to any officer.

**THE TENTH ANNUAL meeting of the American Science Teachers Association will be held in New York City, December 28, 1942.**

# The Science Teacher

201 North School St.,
Normal - - - - - Illinois

***A Service Journal for National, State, and Regional Associations***

***Official Journal of***

ILLINOIS ASSOCIATION OF CHEMISTRY TEACHERS
ILLINOIS BIOLOGY TEACHERS ASSN.
INDIANA HIGH SCHOOL CHEMISTRY TEACHERS ASSOCIATION
IOWA ASSN. OF SCIENCE TEACHERS, Inc.
TEXAS SCIENCE TEACHERS ASSOCIATION





Entered as second-class matter January 30, 1940, at the post office at Normal, Illinois, under the Act of March 3, 1879.

**Subscription rates:** In the United States, $1.00 per year, or $1.75 for two years; in Canada, $1.25 per year, or $2.00 for two years.

# The Science Teacher



VOLUME I | APRIL, 1942 | NUMBER 2

## Recent Developments in the Petroleum Industry

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Rhode Island State College | Kingston, Rhode Island

WITHIN recent years the production of synthetic organic chemicals from petroleum has assumed great industrial importance. A number of factors have been responsible for this development. They are (1) the widespread installation of oil-cracking process with the production of by-product gaseous olefines; (2) improvement in the fractional distillation of condensable gases and light hydrocarbons, thus making it commercially feasible to produce pure hydrocarbon raw materials and pure chemical products from them; (3) a great increase in qualified chemical research personnel in both the chemical industry and the oil and gas industry; (4) a fair increase in what has been called "educated money"; and (5) a great increase in the amount and variety of organic chemicals required for solvents, synthetic resins and plastics, petroleum solvent refining processes, anti-knock fuels, refrigerants and other products.

Up to the present time, the direct manufacture of pure organic chemicals from oil and gas has been practically limited to substances derived from hydrocarbons containing not more than five carbon atoms. A very good reason for this limitation exists. And that reason lies in the difficulty of separating pure hydrocarbon raw materials, which difficulty increases rapidly with hydrocarbons of more than five carbon atoms. Furthermore, many of the organic chemicals for which there is a great demand can be produced from such simple raw materials as ethyl alcohol, acetone, acetic acid, acetic anhydride, ethylene glycol and the like.

THE ADOPTION of improved methods of fractional distillation as applied to the petroleum industry has been slow indeed. For many years, the light gasoline obtained from natural gas was "weather" in vented tanks. This "weathing" process, of course, permitted escape of the lower boiling hydrocarbons. About fifteen years ago, fractionating columns or "stabilizers" began to be used. Following this came the low-temperature low-pressure method of fractionating low-boiling hydrocarbons such as propane and butane. A new type fractionator is used most effectively to separate such materials as isobutane (B. P. — 12.2°C.) and normal butane (B. P.— 0.3°C.). In this manner it is relatively easy to separate nearly 90% of the ethylene from a cracked gas containing about 27% etylene, as a fraction containing at least 98% ethylene and the rest ethane.

THERE is at present an abundance of benzene in the United States. Toluene however, is in great demand as a diluent in lacquers, and it is possible the demand for naphthalene for the production of phthalic anhydride and the hydrogenated products tetralin and decalin may equal or exceed the supply. During the World War, the demand for benzene and

toluene has been met by extensive development in petroleum distillation in Russia, Italy, and Japan. In these countries, however, emphasis has been laid entirely upon the yield of liquid and gaseous products obtainable. Very little by-product coke has been produced concomitantly. In the early years of the industry, the proportion of benzene to toluene obtained from petroleum was about two to one. It has been shown recently that it is possible to produce much more toluene than benzene — frequently two or three times as much.

**Ethylene and Acetylene as Raw Materials**

MANY organic products obtainable from acetylene can also be made from ethylene. The chemistry involved is simple, but the question of relative costs is complex and involves more factors than yields.

Much work has been done on the production of acetylene through the decomposition of gaseous hydrocarbons at high temperatures. According to two workers in this field, Storch and Golden[1] state that when natural gas is available at two cents per thousand cubic feet, it is possible to make acetylene from the gas by the method they studied. At Baton Rouge, Louisiana, acetylene is being obtained in large quantities as a by-product in the production of hydrogen from petroleum refinery hydrocarbon gases. The acetylene is then used in the subsequent preparation of acetic acid.

THE PRESENT situation regarding ethylene and acetylene as raw materials may be indicated by a consideration of some of the many synthetic products now being made from them. Ethylene made by cracking hydrocarbons is the commercial raw material for ethyl alcohol and ethylene glycol in the United States, and everyone recognizes the ever-increasing demand for ethylene glycol for use as an anti-freeze. Synthetic ethyl alcohol made by catalytic hydrogenation of acetaldehyde, or from ethylene made by partial hydrogenation of acetylene, has evidently not been carried out industrially either here or abroad. The greater part of our synthetic acetic acid is made from acetylene, through acetaldehyde, although a plant in England is reported to be making 20,000,000 pounds per year by the catalytic oxidation of fermentation ethyl alcohol. The statement is made by C. P. Partridge[2] that if synthetic ethyl alcohol costs 16 to 18 cents per gallan, the cost of acetic acid made from it by catalytic oxidation should not exceed $0.03 per pound. It is apparent therefore, that the competition between the synthetic products obtainable from acetylene and ethylene is exceedingly close.

1. Storch, H. H., and Golden, P. L., *Ind. and Eng. Chem.* 25, 768, (1933).
2. Partridge, C. P., *Ind. and Eng. Chem.* 23, 482, (1931).

FROM acetylaldehyde, normal butyl alcohol is being produced by condensation and hydrogenation. N-hexyl and n-octyl alcohol are also made in the same process. Carbyl sulphate and its hydrolized product isethionic acid, are made economically by the absorption of ethylene in a solution of sulphur trioxide in cold sulphur dioxide.

Aside from its use as an anti-freeze, interest in ethylene glycol was aroused during the World War because of the advantages of its derivative, dinitro glycol, in low freezing nitroglycerine dynamite. Also, ethylene chlorhydrin, the intermediate product in the preparation of ethylene glycol from ethylene, was used in the older method of making mustard gas. Ethylene obtained from cracked hydrocarbon gases by low temperature fractionation is advantageously used in the manufacture of ethylene chlorhydrin, glycol, and similar derivatives. Another important product made by the direct catalytic oxidation of ethylene is ethylene oxide. This promises to be a raw material of significant economic value in the production of ethanol amines and glycol ethers.

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# An Announcement of Plans for Reorganizing Department of Science Instruction of N. E. A.


JACK HUDSPETH

President

Department of Science Instruction, National Educational Association Austin, Texas


EVERY science teacher knows that the status of science in the curriculum of his school is insignificant in comparison with the importance of science in the lives of his pupils and their parents. This discrepancy is due to increase because of current advances in science and industry. But the demands of the time for better-educated citizens will undoubtedly soon impel school administrators to remedy this situation by putting more science in the curriculum and requiring more science instruction for each pupil.

Therefore this is the time for every science teacher to do a better job of teaching and to get recognition and rewards for the service. Also it is up to the Department of Science Instruction of the National Educational Association to (1) help science teachers improve their work and (2) impress upon school administrators the need for more and better science instruction of our nation's schools. To do this more effectively, the Department is considering a thorough revision of its organization.

IF THIS revision is approved by its officers and directors, next September 1 the Department of Science Instruction will become The American Council of Science Teachers, a department of the National Educational Association. If current plans are completed, the Council will function mainly through existing local, state, and regional organizations of science teachers, each of which may become a section (an affiliate) of the American Council of Science Teachers. A part of each Council member's dues will be returned to the local organization that he designates.

Plans call for the American Council of Science Teachers to publish (1) a yearbook, each issue of which will be devoted to one problem in science teaching, and (2) a magazine of useful ideas and information for the classroom teacher of science. Both publications will be sent free to each member of the Council, whether he joins the Council directly or through one of its affiliated organizations.

IT IS planned that the American Council of Science Teachers will utilize *The Science Teacher* as its official magazine. Each affiliate of the Council will select one of its members to serve on the Council's board of directors and serve as a contributing editor on the magazine. The Council itself will hold a 3-day meeting each summer with the N.E.A. convention. However, a member of the Council's board of directors need not attend the convention in order to participate; voting will be done by mail (postcard).

It is planned that the dues would be $1 per member, a portion of which would be returned to the local section of the Council that the member designates. Each member would receive the magazine and yearbook.

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Detailed plans of this American Council of Science Teachers have been sent to over a hundred leaders in science instruction throughout the nation, and the replies now coming in are very enthusiastic. Several local and state science associations have already expressed a desire to become sections of the Council, if it is formed, and outstanding science teachers in several cities have begun to organize local science councils which could become sections of the proposed

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# Editorial and News

## Losing Nothing and Gaining Much By Affiliating With a National Association

WHY NOT take the decisive step when there is nothing to lose and much to gain, so reason many science teacher association leaders as they consider the move to affiliate with an active national science teachers' organization. In their state and regional associations there are many problems, some of which are developing out of the present national emergency. It is difficult to maintain interest among the membership, still more difficult to bring them any distance to a meeting. Payment of dues is somewhat less than one hundred percent, often due to the members having little tangible returns for the money invested. Good speakers are hard to get. Under these conditions members will drift away and even the most ambitious leaders may despair of success. Such is the present history of a number of isolated science teacher groups.

The picture just presented is not overdrawn for some areas, if we may judge from the evidence that comes to us. Association leaders are seeking a means of strengthening their local groups, and rightly so. They are seeing the advantages of affiliating with a strong national association that can help — that can provide worth while services.

IN THE past, local associations have held back with regard to affiliation because they felt they would be losing their prestige and their identity as a group. And with some organizations this may have been true. But, fortunately, with our present leading national associations of science teachers the ultimate in democracy prevails and an association may have all the advantages of affiliating with a national group and yet preserve its identity and complete freedom of action. Such is the organization of the American Science Teachers Association and the new American Council of Science Teachers now being formed by the reorganization of the Department of Science Instruction of the National Educational Association.

The organization of the American Science Teachers Association provides specifically for the preservation of the local group. (See the plan of organization as presented in the February issue of this journal.) Under this plan a large number of science teachers' organizations have sought affiliation. The fact that these affiliations have been continued is ample evidence that the arrangement has been satisfactory.

The plan for reorganizing the Department of Science Instruction of the National Educational Association as the American Council of Science Teachers is equally democratic both in form and in actual operation. (See the discussion of reorganization in this issue.) A number of regional science teachers associations are already planning affiliation with the American Council and many others are likely to follow.

ONE OF the most wholesome things about these two leading national associations for science teachers is the friendly spirit of cooperation between them. This is due to a high type of leadership which, fortunately, they have, a leadership that is willing to subordinate personal interest to the welfare of teacher groups. Incidentally this is a fundamental requirement for success in any organization work.

But let us note a few of the outcomes of national affiliation. To be specific, we may point to the difficulty of getting before the teachers nation wide a plan for

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## DEPARTMENT OF SCIENCE INSTRUCTION ANNOUNCES CONVENTION IN DENVER

THE 1942 convention of the Department of Science Instruction of the N.E.A. will be held in Denver June 29 and 30 and July 1, along with the convention of the N.E.A. itself. An interesting, worthwhile program is being planned. The theme of the convention will be "Science Instruction for the World of Tomorrow," stressing the need for preparing public school pupils for successful living in the world of science which will certainly follow the present conflict.

Numerous outstanding teachers of science and scientists have been scheduled for appearance on the program. July 1 will be Denver Day, and on that day science teachers of Denver public schools are planning to take convention visitors on a tour of the Colorado Museum of Natural History, a guided field trip into the Rocky Mountains, and a tour through the Chamberlain Observatory. A chuckwagon dinner on Lookout Mountain is also being planned.

CHAIRMAN of the Denver Arrangements committee is Mr. Howard Williamson of Manual Training High School, Denver. Chairman of the Colorado division of the program committee is Supt. S. Clay Coy of the Jackson County High School, Walden, Colorado.

Impending changes in America's public schools, made necessary by the demands of war, make it advisable for every science teacher to attend this convention. Train and bus schedules to Denver are excellent and round trip fares are surprisingly low.

## AN APOLOGY

TO SOME of the associations affiliated with the American Science Teachers Association our apology is due for omitting their names from the list in the February issue. There were so many of the names and the space was so limited that evidently some of them were crowded out in the make up of the page before going to press. This we regret and are including them in the present issue.

## OUR ADVERTISERS

TOO frequently science teachers accept advertising in their journals as a matter of course without giving much credit for the essential part commercial firms have in making possible a better journal. So we think it only right to give them the recognition due.

We do recognize the fact that our advertisers expect a return for the money invested. They would hardly remain in business if they did not observe this principle. However, aside from a purely business consideration, we find among the managers of these firms many fine individuals who also feel it is important to invest in human progress — in advancing the work of science teacher organizations.

The records of some of our advertisers speak for them. Some have been in every issue from the beginning of this journal. Several others have similar records for many years. This definitely shows the interest taken in a service for science teachers associations. Just recently we had a commercial firm write us specifically that they were definitely interestd in supporting journal service for science teachers associations that we serve.

In view of the active support of our advertisers we believe they are deserving of special consideration when we find it necessary to buy goods such as they produce. Moreover, as a friendly gesture from us, we would like for you to include a note with your order stating that you saw their advertisement in *The Science Teacher* and that you appreciate their support of your journal.

## OUR FRONTISPIECE

For our frontispiece we are indebted to the photography club of the Cherokee County Community High School of Columbus, Kansas. The sponsor is Mr. Harold Brandenburg, who is also visual aids director for the high school.

# The National Committee on Science Teaching

IRA C. DAVIS

University of Wisconsin — Madison, Wisconsin

THE greatest impetus for the organization of a representative committee of science teachers came from the Educational Policies Commission. Their report on "The Purposes of Education in American Democracy" raised challenging issues which all subject matter areas should consider. What can science education contribute toward helping pupils to better understand democracy? How can it help boys and girls to live in this democracy? How can science help to give boys and girls a better living? How can science assist in solving the social problems it has helped to create?

The main purpose in organizing the committee was to secure a representative group of science teachers to interpret and implement the recommendations made in the reports of the Educational Policies Commission. As the work of the Committee progressed, it was found that the recent reports of other educational organizations and agencies would be helpful.

THE initiative for the organization is probably due to the efforts of the officers of the Department of Science Instruction of the National Education Association, although it is difficult to tell where any such movement really begins. The Department was successful in getting funds from the National Education Association to help organize and support the activities of the Committee. Nine other national organizations of science teachers accepted the invitation to cooperate, and they also have contributed financially, as well as in many other ways. Two other national organizations sent delegates to participate in some of the meetings.

The first, or organization, meeting was held in Cleveland in February, 1939. Thirty-five representatives attended this meeting. Records demonstrated that the teachers present were in direct contact as administrators, supervisors, or heads of departments with more than 5,000 science teachers. Attendance at later meetings varied from 60 to 100 teachers. In a check-up at two meetings, it was found that the teachers present represented more than 11,000 teachers. I mention these figures to point out the fact that the Committee was really inerested in getting a large number of teachers to cooperate and assist in the work. Every effort within the limits of time and funds was made to acquaint large numbers with the work and progress of the Committee.

THE Committee practiced democracy as it understood democracy. At no time has the Committee taken the position it should write a report or reports that would represent its own opinions without first considering the suggestions and recommendations of thousands of teachers. It at no time has had any desire to dictate a program. Rather, its function has been to study, to interpret, and reinterpret, to consider and re-consider, to plan and re-plan, and finally produce reports which would represent the thinking and actions of many teachers.

The Committee members have in spirit at least attempted to be scientific and at the same time democratic.

The Committee has held nine meetings in all. Three were joint meetings with other groups. The general committee consists of 17 members elected by the cooperating organizations. More than 265 other teachers have made valuable contributions and are called consultants. They come from all parts of the United States, and represent all types of schools, as well as all school levels.

MORE than 2,500 teachers answered the opionnaire and questionnaire distributed by the Research Division of the N. E.A. An additional 3,000 teachers assisted in the work of the Sub-Committee on Needs.

It soon became evident that it would be desirable to divide the general committee into several smaller groups to make it possible for the large number who attended the meetings to take part in discussions. As a result, seven subcommittees were formed — namely, philosophy, needs, teacher education, evaluation, effective procedures, effective materials, and administration. Members of the general committee were elected chairmen of the subcommittees. Other members of the committee and the large number of consultants were assigned to the subcommittees which they preferred. In order to keep all subcommittees working together and in some agreement with each other, it was decided that they should meet together several times during the two or three-day meetings and still more times in subcommittee groups.

In this way it was possible to make the best use of all available talent and keep the work progressing on a more or less sequential order.

I HOPE you do not think there was unanimous agreement of opinion or that all members of the Committee always agreed on everything that was proposed and accepted. There were many differences of opinion. Sometimes they were more or less violent. But not once do I recall the differences were personal or that anyone attempted to force others to accept his or her opinion or point of view. Every proposal and every action had to run the gauntlet of opinion of all members, and many times of all the consultants.

Oftentimes there were misunderstandings, but as far as I know never a questioning of motives. Sometimes slight jealousies were apparent, but they soon disappeared as the discussions progressed and understandings became more complete.

I AM certain that the members of the Committee do not want me to give the impression they were all saints, or could do no wrong, or never made any mistakes. Personally, I am convinced now, more than ever, there is something to scientific training and thinking which makes it possible for such a large and capable group to work together so harmoniously and so effectively — yes, too, democratically.

You are no doubt raising this question by this time: Could such a large group ever come to an agreement on anything?

I am glad to report that three subcommittees have completed their work. Their final reports are now ready for the printer. The three reports completed are —"Science Teaching for Better Living—a Philosophy or Point of View"; "Redirecting Science Teaching in the Light of Social-Personal Needs," and "The Education of the Science Teacher." A fourth report on effective teaching procedures and materials is expected to be completed by summer or fall. It will contain the reports of the subcommittees on materials and procedures and possibly some recommendations of an administrative nature.

AT SOME time in the future it will be necessary to evaluate the suggested program. There will be time then for a complete report on possible ways and measures for evaluating what teachers have attempted to do.

I am sure you do not want me to tell you what is in the reports. As chairman I should be the last one to "beat the gun" and tell you what they contain before they are published. At no time has there been any attempt to be secretive. I can give you a hint of what is in them by telling you what is *not* in them.

First of all, you should not forget that the members of the Committee and practically all of the consultants are science

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# Helping the Victory Garden Program

M. C. LICHTENWALTER

Lane Technical High School Chicago, Illinois

NOW is the time to initiate national offense in civilian defense. Specifically, these few remaining weeks of the spring of 1942 is an opportune time for every science teacher to go all out in a national offensive to insure an adequate food supply. Adequate? You be the judge. The federal government has already earmarked thirty-one per cent of our normal canning supply for their own needs. This before the seed for the crops is in the ground. Science teachers, especially biological science teachers on the home front, have an excellent opportunity to be of unlimited service to their community in this matter. One phase of this service is aiding the aroused public in their "Victory Garden" campaign.

Biology teachers are not necessarily experienced gardeners. However, they have the potential to become good gardeners if they so desire, or at least they may be of service to those older gardeners and newer ones of the community. They may aid them with counsel, guidance and suggestions. The fundamental knowledge of life processes, of plants in particular, will stand the teacher in good stead in the Victory Garden program. The longer the present conflict and world disturbance lasts the more important will this service become.

WE BIOLOGISTS and plain dirt gardening enthusiasts here at Lane have launched an extensive gardening campaign for 1942. The national transportation system is already operating at 130 per cent of theoretical capacity on priority shipping. Speeds can not be increased and rolling stock must lay up periodically for repairs. Any relief we can give the system by local vegetable production will be in direct proportion to our efforts. From this reasoning we formed a "garden clinic." This is a place where the community may come to discuss garden problems, see tools, secure literature, and our own twenty-page handbook written for gardening needs in this locality.

The purpose of this article is to give you in detail some of the phases of this work that we are doing which would be of service to you. Perhaps the suggestions will permit you to serve your community better if you so desire. You as a science teacher may set up sample gardens, demonstration gardens, and even maintain a school garden. The sample garden should be set up inside the school building on an accessible area as soon as possible. The demonstration garden will be planted out as soon as danger of frost is past. The school garden will run parallel with the community gardening campaign.

**The Trial Garden.** The trial or sample garden would be set up in an area accessible to the public but inside the building. The trial garden or sample garden is to be used to create pupil interest in their own home garden plots, to stimulate gardening as a school project in the community, and to demonstrate to the pupils and public the desirable types of vegetables and to simulate the growing conditions.

THE FLOOR area must be flooded with sunlight for at least six hours per day if it is to be maintained for a period of over a week. Unless the floor is terrazzo or concrete, a protective layer must be put down to control the moisture. A layer of roofing, linoleum, sheet metal, or other material will be suitable for this purpose. A wood frame made of boards six or eight inches wide and to the size

* The handbook mentioned in this article may be obtained free by writing the school or author. Include five cents postage to cover cost of mailing.

desired will suffice. An acceptable area size would be four by ten or more feet. The area would be divided into rows across the short distance, each row reserved for a specific vegetable.

This sample or trial garden would be set up by the teacher and pupils as a class project. The students would have previously started their vegetable seeds in the growing room. They might have started them in seed flats or boxes, flower pots, or discarded tin cans. A start of several weeks will give goodly sized plants for this trial garden. Its use is to show vegetables growing in their garden plan before the community gardens are planted. There could be a mimeographed sheet explaining the garden, its purpose and possibilities. Of course this garden is to give a pre-idea of garden possibilities.

**The Demonstration Garden.** The demonstration garden is a community practice garden. Located on the campus on an idle area of the athletic field accessible to the people of the community for observation. This garden is a place where the people may see what they should do next in their own garden. This is accomplished by starting the vegetables early and having them several weeks in advance of the garden vegetables of the community. In this manner the people may observe the care and culture and learn what they should do next in their own garden.

The vegetable plants, similar to the ones for the trial or sample garden, are started in the school growing room weeks prior to the planting out date. This planting out date is as soon after the danger of frost is past as possible. Unlike the trial or sample garden, being useful only for a few days or weeks or two, this is a permanent garden with the maturity of its plants stepped up several weeks ahead of the other gardens of the community.

Here at Lane our demonstration garden will be divided into three parts. The first will be about a third the size of our recommended student garden; the second, one-fifth to one-fourth the size of our recommended family "Victory Garden"; and the third, large enough to grow two or more of each of the vegetables which we recommend to be grown in the truck garden.

ONE PROBLEM is that the vegetable plants will be set out at a time when they will push the season's slightly. As a result, they will be sensitive to the cooler weather. In addition to hardening them in a cold frame, you perhaps will need commercial or make-shift plant caps for night protection of your plants, on occasions.

**The School Garden.** For many science classes throughout the country the school garden is part and parcel of the regular school curriculum. The writer, while doing his practice teaching in a certain metropolitan high school several years ago, spent a most enjoyable summer watching and participating in the progress of the school garden. The instructor in charge, and the author as a practice teacher, devoted a part of each class period working with the students in the school vegetable garden. The school garden as such is no different than any other vegetable garden. Its content and care will depend entirely upon local conditions. It can make an excellent summer project for both teacher and pupils. Contacts here can be more informal, unstilted, and more friendly than they can ever be in a classroom for the very reason that there is a certain unity of thought, action and purpose created in the school garden unattainable in the class room.

**Garden Plots.** The Lane garden committee suggests three garden situations. They are the small, medium and large plots. The small garden is termed the student experimental garden, ranging in size from ten by fifteen feet to two or three times that size. If properly man-

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# Some Projects in High School Biology

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THE biology course offers many opportunities to bring into the classroom "built -at-home" apparatus, from which the pupil may recite. Using this equipment, the class as a group may make a series of observations. The members of the class take a more critical interest in something some member contributes; so if results are not what they should be, there arises plenty of wholesome questioning on the part of the pupils.

Here are some "pupil-built-at-home" projects suitable for high school biology students.

### Project I.

A Study of the Effect of Gravity on Growing Plants—Geotropism. Figure III shows a simple method using four potted plants mounted on a board and held in such a position that they can be rotated in any direction. Rapidly growing plants may be used. Different varieties of plants

Fig. 1. Watching a plant grow, using his own apparatus.

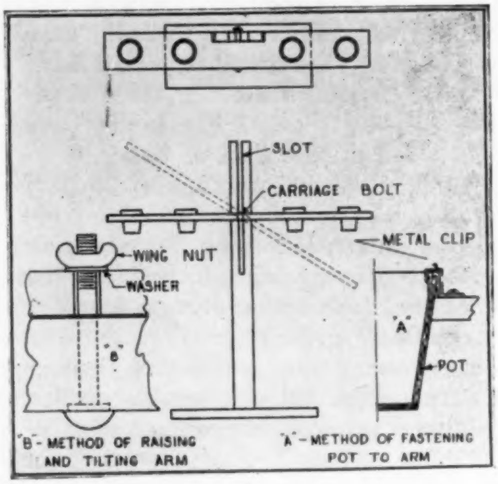



Fig. 2. Arrangement of gravity apparatus.

may be studied at the same time or four plants of the same variety. Simple drawings, which illustrate how the apparatus is made, are shown in Figure II.

THE support is made of a piece of wood three inches by twenty inches, which has a slot cut ¼ inch wide and 10 inches long. This upright is fastened to a base, 10 inches long. This upright is fastened to a base, 10 inches by 10 inches, with two 3½ inch angle irons (dime store variety). The board carrying the flower pots is 5 inches wide and 25 inches long; in this board are cut 4 holes, 3½ inches in diameter. These will hold a 4 or 4½ inch flower pot. These holes may be cut in the board with a jig saw — either hand or power. A ¼ inch hole is bored through the center as shown, in which is placed a ¼ by 6 inch carriage bolt, fitted with a wing nut and washer. This arrangement makes it very easy to raise, lower and turn the plants in any direction. The pots may be held on the board with a clip made from a thin strip of metal fastened as shown in "A." As shown in Figure 1 the pots may also be held in

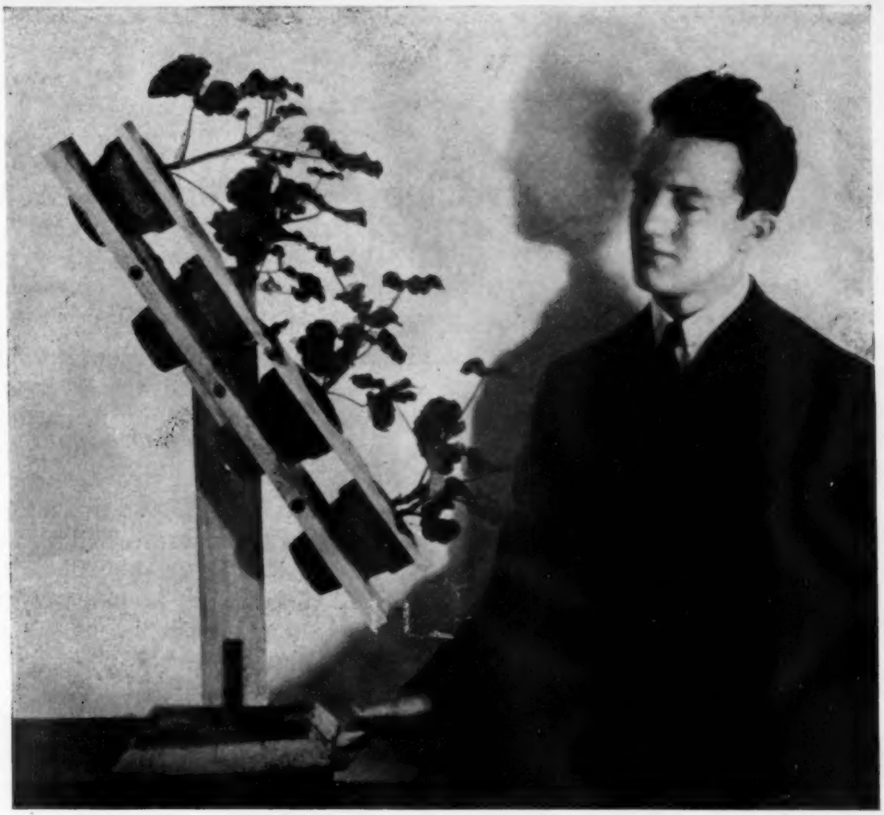
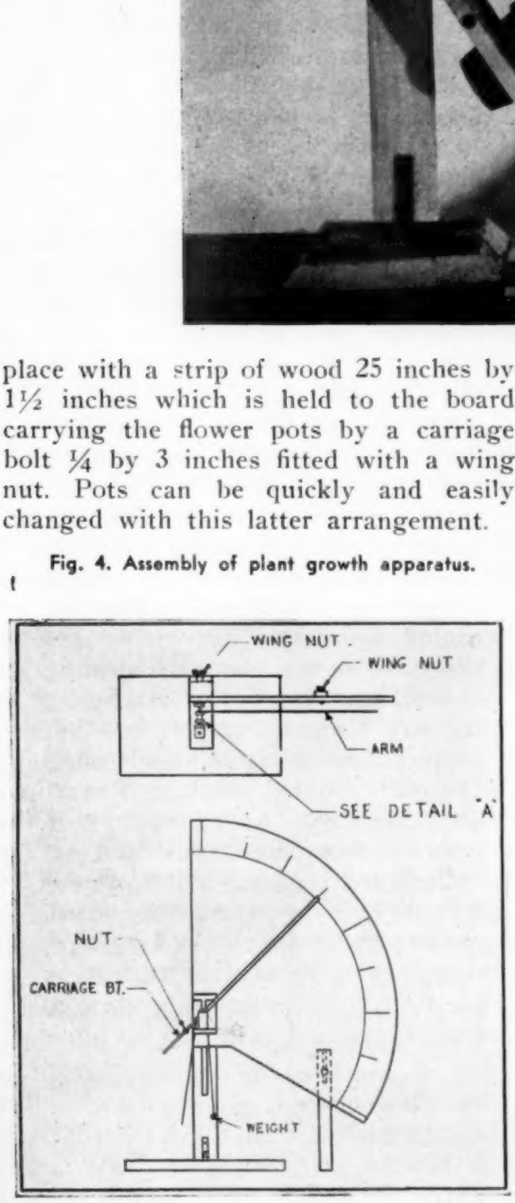


Figure 3. Potted plants mounted to show effect of gravity on direction of growth.

place with a strip of wood 25 inches by 1½ inches which is held to the board carrying the flower pots by a carriage bolt ¼ by 3 inches fitted with a wing nut. Pots can be quickly and easily changed with this latter arrangement.

Fig. 4. Assembly of plant growth apparatus.




List of materials needed to make this project:

1 piece 5 in. x 25 in. to hold the pots.

1 piece 3 in. x 20 in. upright.

1 piece 1½ in. x 25 in. to hold down pots.

1 piece 10 in. x 10 in. apple box end.

1 ¼ x 6½ in. carriage bolt.

1 ¼ x 3 in. carriage bolt.

2 ¼-inch wing nuts.

2 3½-inch angles with screws (dime store.

THE total cost of the hardware is less than twenty-five cents. Almost any odds and ends around the house will do for the lumber needed. Any puplis handy with tools will be able to make this project. Plants in rapid growth will produce the best results, such as potato, tomato, etc. Many questions will arise: Why do trees grow straight up on a side hill? If the plant starts to grow straight up, will it turn if its position is changed? What part of the plant seems to be involved in these changes?

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# The Physics Club As an Aid to Teaching

ARTHUR HOUSTON

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FOR SOME years past extracurricula activities in the high schools have found expression in the form of various clubs. The larger the school, naturally the club form of activity will take on a wider scope, both in the variety of clubs and the individual performance of each of the clubs themselves.

All high school clubs regardless of the particular aspect of school life which they represent have certain fundamental points in common:

1. A definite set of objectives
2. A suitable membership
3. The usual officers
4. The sponsor

Objectives might be listed under two heads — visible and hidden. The former would include such worthy desires as to promote the general interest of the school a definite program designed for the welfare of the membership of the club; projects which will be a distinct addition to the teaching equipment of the classes, etc. The latter class of objectives which we have termed hidden or invisible objectives, are after all the main reason why any club should exist. These objectives are not what the pupils do in the club in arriving at chosen objectives, not what the pupil consciously aims at, but what the club does to the members as a collective whole and as individuals.

THE membership of the club should consist of those pupils who have an earnest desire to belong for the sake of promoting their own special interests, through helping achieve the objectives for which the club stands. In no case should membership be permitted to those who join for the sole reason of obtaining EXTRA CURRICULA CREDIT. The nature of the club will determine the size of the membership. Membership should not extend beyond the point where the group becomes cumbersome. Inefficiency and a definite hindrance to the fullest individual expression is the result of too large groups. Restricting membership to those pupils who have attained high scholastic standing seems to be a mistake. The pupils with lower marks probably need the club experience more. Membership in the club gives them one place in school that is different. There they can feel they amount to something.

THE character of the officers of the club and how seriously they take their jobs determines the measure of success the club will have. It is the job of the officers to convince the membership that the CLUB IS A PUPILS' ORGANIZATION. When this is done, orderly conduct and business-like demeanor in meetings naturally follows. The president should be the spark plug that keeps up interest and promotes activity. He should know his members and appoint committees that will produce. He should know how to conduct meetings according to the best parliamentary procedure. In doing this he teaches the others and achieves one of the club's objectives. The secretary should write careful and complete minutes. The minutes should include the programs. Where possible these minutes should be typewritten and kept in a suitable book. This will serve as a permanent record. This record should be required as an annual report by the school office.

THE sponsor of the club, of course, is the moving spirit behind the whole. He should keep in the background and do a lot but not seem to do so. THE CLUB MOST CERTAINLY SHOULD NOT BE ANOTHER CLASS FOR THE SPONSOR. He should work on

the officers and committees to drive the point home that the club is a PUPILS ORGANIZATION. The sponsor should seem to serve in an advisory capacity only. The sponsor should demand worthwhile results. Meetings should be permitted only when a definite and suitable program has been presented to the sponsor. Meetings should be inclined to be brief with interest arousing activity predominating. It is better to have fewer meetings and have real good ones.

THE foregoing applies to any kind of a school club. However, the dominant idea in this article was to be a definite and concrete discussion of a special club — the physics club. Assuming that we have such a setup as is indicated from the discussion thus far, let us see what we will do with it in this special case of the physics club.

Physics has had the unpraiseworthy distinction of having been the most unpopular subject in America. It still lives up to its reputation. Ask anybody. This being so, what nobler objective could be chosen for a physics club than to propose to make physics interesting?

Before anything can be done about making physics interesting we will have to inquire into the reasons that gave the subject its bad reputation. It has been quite conclusively shown that text book assignments, formal recitations, and problem solving usually broke down the morale of even the staunchest, most promising, and best intentioned. Lord Kelvin is credited with having said that "unless one can express his knowledge of science mathematically, then he knows nothing." That may be all right for college professors, but high school pupils prefer to "know nothing" if they have to express themselves that way. And besides they do not know the mathematics.

INVESTIGATION shows that high school physics is very much the same today as it has been for generations both in content and teaching method. Physics keeps its old reputation. What does the average boy care about the unexciting exploits of such characters as Archimedes, Galileo, Boyle, etc., with their cold, unrelenting laws. Why talk about these men with their levers, falling bodies, and volumes of gases. That is slow motion stuff. Why throw such a wet blanket over the natural interests of pupils?

The world of today is full of action. Let us turn to Edison, Marconi, DeForrest and their colleagues whose life stories read like fiction. Let us get our physics out of radios, automobiles, airplanes and the other new applications and reach back into the distant hard bitten past only when we need to in order to learn more about the things wherein our interest lies. So much has happened in the past fifty years — more than in all the ages before. So much good interesting physics. Why not have more of that in the physics course?

THE physics club can answer that question. The club can bring in the new physics. Funds are not readily available for purchasing new equipment for demonstration purposes. The club members can make this equipment. They can not make it all in one year, but year after year each successive club can make some. This equipment will be used in the programs and passed on to the clubs that follow and to the classes.

Let us see what apparatus and equipment members of a club can make and how to go about doing it. Let each member chose to do or make that thing which carries a special interest for him. The sponsor should furnish a list of suggestions in the event of a shortage of ideas on the part of the pupils. The objective of the club is kept in mind as this list is made — to make physics interesting. This is to be done by demonstrating modern physics and applying new methods on the old physics.

SPACE permits only a short list here with brief directions or comments:

(Continued on page 42)

# Semi-Micro Methods in High School Chemistry

S. D. LAW

Exeter High School Exeter, California

FOR SOME time I have felt that techniques and suitable experiments in chemistry should be worked out using small quantities of material. This does not mean that the older macro procedures should be done away with, but that there is a place for both.

The separation of insoluble precipitates by centrifuging I have found very unsatisfactory for class use. I prefer Barber's small packed tubes (cotton or glass wool) with pressure from above for my own work. Also I have found the use of solutions whenever possible rather than of dry materials adds to the speed of class work. This is particularly suited to semimicro procedures. The use of small dropping bottles is very convenient. These should be racked in advance for the week and set out so that four to six students may be provided with a rack.

Spot plates where possible rather than test tubes are an aid to keeping things clean. The use of the micro spatula instead of the horn spoon or larger scoop limits quantities of dry solids used in a very simple way.

The following introductory material and experiments in semicro laboratory work as used in my high school chemistry classes indicates somewhat how the work is approached.

### Semimicrochemistry Laboratory Techniques

EXPERIMENTAL work in the laboratory is for several purposes. Among these may be mentioned:

(a) familiarity with some chemicals,
(b) familiarity with some chemical changes,
(c) familiarity with laboratory equipment and practices used in college and industrial laboratories, and
(d) an insight of the control of commercial processes by the chemist.

Many chemists are expensive. Many are dangerous — always more so in large quantities. A little salt in food is desired but a large dose may make you sick. The powder in a toy pistol "cap" may make an interesting sound, but a ton of the same powder exploded at once may be devastating.

Many chemical processes are slow in the quantity used in industry but a very small amount may react rapidly enough so the experiment can be completed in a reasonable time.

For all those and many other reasons laboratory work usually has made use of fairly small quantities. For many years test tubes, flasks, beakers, bottles, etc., have been used which usually held not over a pint and commonly much less. This we will call macro chemistry.

ABOUT 1930-31 Dr. F. Emich of Vienna perfected a scheme of chemical analysis using such small quantities that much of the work was done with a microscope. His book "Microchemical Laboratory Manual" was translated and published in the U. S. in 1932. This technique has been developed a great deal since then. This is microchemistry. Microchemistry requires very careful training and skilled technique. It is not at all suited to the beginner. Following the development of microchemistry, various chemists at many institutions felt that an intermediate technique between the old macro chemistry and the new microchemistry could be perfected. This is known as semimicrochemistry.

By no means should we assume that semimicrochemistry has been perfected. There are at least four quite distinct techniques which are being used and improved. Some books have been pub-

lished and others are coming out each year.

Fritz Fiegl of Vienna has brought a system of "spot tests" on paper to a fair degree of success and his book "Spot Tests" is accepted as authoritative at the present time. This is an analytical procedure. The British Drug House has issued a book an analysis of certain things in drugs, particularly impurities, using this technique.

ANOTHER technique makes wide use of the spot plate — a piece of porcelain or glass with rounded, smooth depressions in which reactions between small amounts may take place and be observed. This is an admirable procedure for many experiments both in analysis, for which it has been widely advocated, and for general inorganic chemistry experimentation, but its use is limited.

The third technique for analysis depends on the production of insoluble materials and their separation by whirling or centrifuging. In order to get done quickly this is best done with semimicro quantities of two milliliters or less.

A fourth technique developed by Barber also depends on the production of small quantities of insoluble precipitates, but with separation by filtering with a small filter which will handle about one milliliter of material using pressure. Speed is the advantage of this method.

FOR ANALYSIS another new development has been the introduction of organic chemicals for specific tests. Litmus and phenolphthalein have been widely used for a long time. The newer procedures use great numbers of organic chemicals, each of which may be specific for a certain material.

All of these techniques can be and will be adapted to elementary work with solids and liquids. In most cases it is not yet suitable to gases for beginning student. This set of laboratory directions then will include as many of the newer microchemical technique as seems practical. Mixed with that is the older, more thoroughly standardized macrochemical technique.

**Experiment: How Much Chemicals?**

There are some advantages in using small quantities of chemicals in many experiments: economy, safety and speed being the main ones.

A. Put 1 drop of phenolphthalein on a piece of filter paper, 1 drop of phenolphthalein in a test tube and 5 drops of phenolphthalein in a small beaker. Add 1 ml water to the test tube and half fill the beaker. Add a drop of $NH_4OH$ (ammonium hydroxide) to the moist spot on the paper, 1 drop to the test tube and 5 drops to the beaker. Record the results in the table.

1. Is there any particular difference between the changes observed on the paper, in the test tube, and in the beaker?
2. Were these changes physical or chemical?

B. Put 1 drop of $K_2Cr_2O_7$ (potassium dichromate) solution in a test tube, 1 drop on paper and 1 drop in a spot of a spot plate. Now add 1 drop of $AgNO_3$ (silver nitarate) solution to each.

3. Can you see the color changes equally well in each case?

Wash all dirty apparatus.

C. Record the colors observed.

| | Phenolphthalein and $NH_4OH$ | $K_2Cr_2O_7$ and $AgNO_3$ |
|---|---|---|
| Beaker | ......... | ...xxxx... |
| Test tube | .......... | .......... |
| Spot plate | ...xxxx... | .......... |
| Paper | .......... | .......... |

D. Conclusion.

4. Paper is better than glassware (where it can be used) because
   a. ............................
   b. ............................
5. One important advantage of the spot plate over the test tube is...
   ...................................
6. Will paper be satisfactory if the product is white?

(Continued on page 46)

## Science for Society

EDITED BY JOSEPH SINGERMAN

● A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

# Your Civilian Defense Library

"Once upon a time, according to an old Arab legend, a pilgrim who had left Alexandria met another traveler on the road, going toward the city. 'What are you going to do?' cried the pilgrim, who recognized the other to be the Plague. 'I am going to take three thousand lives in Alexandria,' answered the Plague. The pilgrim considered the number and, so as not to anger the Plague into killing even more of the faithful, said nothing. On his return from his pilgrimage he met the Plague again, but meanwhile he had had news of what had happened in Alexandria. 'Why did you lie?' he cried. 'You said that you were going to take three thousand lives . . . but they tell me that thirty thousand died! Why, in the name of the Prophet, did you do that?' The Plague looked sadly at the pilgrim and answered: 'What they told you is true. But I did not break my word. I took only three thousand. The others died of fright.'

"One need only substitute the term 'Air Force' for 'Plague,' and 'World' for 'Alexandria,' to turn this Arab legend into a very modern parable, at once sad and cynical."

WE SCIENCE teachers can do much to help save those figurative twenty-seven thousand lives. It is not simply that we *can* save people from their own fright and panic; we have an obligation to them. Daily, millions of youthful pairs of eyes and hungry minds confront us. As the realities of modern warfare become more imminent, the more will they look to us for the words of reassurance and strength, for this is a war made horrible with the aid of science. So far as the fear of the unknown prevails, to that extent will the enemy succeed. The science teacher can dispel that fear of the unknown. Civilian defense must be built upon a foundation of confidence, of knowledge and understanding. The community turns with reason to the science teacher for an understanding of the nature of modern anti-civilian weapons.

There are opportunities, in teaching topics relating to combustion and fire fighting, in explaining the construction and action of incendiary bombs, as well as means of dealing with them. The chemistry and biology courses provide opportunities for explaining the properties and physiological effects of war gases, and means of protection against them. Physical principles are involved in the operation of planes, the application and effect of bombs as well as means of protection against them. Your objective presentation (and don't forget your sense of humor) will contribute much toward assuring that there will be the necessary calm and intelligent action when the emergency comes.

The fable related above is quoted from "Bombs and Bombing," Willy Ley (Modern Age Books, New York, 1941. 124 pages, $1.25). This is an instructive book, written in popular style. Ley is reassuring to those who may be obsessed with frightful nightnmares induced by horror tales like H. G. Wells' "Shape of Things to Come."

Ley is recommended reading in conjunction with "Civil Air Defense," Lt.-Col. A. M. Prentiss (McGraw-Hill Book Company, New York, 1941. 334 pages,

$2.75). The science teacher, while benefiting from the popular style and reassuring presentation of the former, will feel a need for the more detailed, more technical treatment by Prentiss. His style and the plane of his writing is well known to those familiar with his earlier book, "Chemicals in War." Here you can find statistical data and test results on the effects of bombs of various types administered under different conditions in which the civilian population may conceivably encounter them. The practicability of various measures of protection is treated with equal care. Prentiss discusses a number of other phases of civilian defense, such as warning service, rescue and debris clearance, service organization, training of personnel, and protection of industrial establishments and the home.

CIVILIAN defense would be entirely inadequate if it were limited to the technical phases of the mechanisms of attack and means of civil protection against the direct onslaught by the enemy. Colonel R. Ernest Dupuy, G.S.C., and Lieutenant Hodding Carter, F.A. ("Civilian Defense of the United States." Farrar & Rinehart, New York, 1942. 296 pages, $2.50 list) show a clear recognition of domestic problems whose solution is essential to a successful program against enemy inroads on the domestic scene. Their chapter on "Food Wins Wars" is a frank recognition of the fact that Hitler stole a march on us when we permitted the starvation of a large portion of our population who today reveal the ravages of hidden deficiencies. They characterize our reawakening as an American "revolution based upon the principle that the citizen has as much right to proper nourishment as to public schooling." Referring to the insidious effects of hidden deficiencies (which applies to 75% of our population) it is pointed out that "Germany has employed this knowledge to the advantage of its own people (sic) and to the detriment of her conquered foes, employing balanced foods to bolster her troops and denying it to keep inert the conquered nations." They draw from facts revealed by Brigadier General Lewis B. Hershey, Deputy Director of the Selective Service System, and by the National Nutrition Conference for Defense, of May 1941. They do not stop here, but point to effective means now being undertaken, for improvement of the standard of nutrition of the citizens of our nation. In connection with this great forward step are mentioned the Food Stamp Plan, Free Lunch Programs, milk depots and cooperatives. They make no mention, however, of the tendencies during the past decade to curtail purchasing power of the mass of working people through rising prices and by the policy of "spreading the tax base," except for a vague reference in the chapter, "An End to Luxury," to the effects on the purchasing power of different groups of the population, as revealed by a Gallup poll in the summer of 1941.

Despite an unfortunate reference to the discredited Jan Valtin, their stirring chapter on the "Saboteur and Arsonist" presents a wholesome warning. The need and importance of a defense organization of civilian volunteers to augment the police forces is indicated in the chapter, "The Cop on the Corner." They discuss the role of women in defense. In still another chapter, the authors comment on labor's part, and point to vast untapped reservoirs of potential loyal Negro labor, which stupid prejudice has failed to develop. The current magnificent response of organized labor, in support of the national defense program, brings to a realization the hopes of these authors. Dupuy's and Carter's chapters on "Propaganda" and on "Morale — the Great Intangible" are fitting additions to the literature on civilian defense.

THE TWO authors have undertaken an important mission. They have done

(Continued on page 48)

## Science Clubs at Work

EDITED BY KARL F. OERLEIN
State Teachers College California, Pennsylvania

**A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Oerlein.**

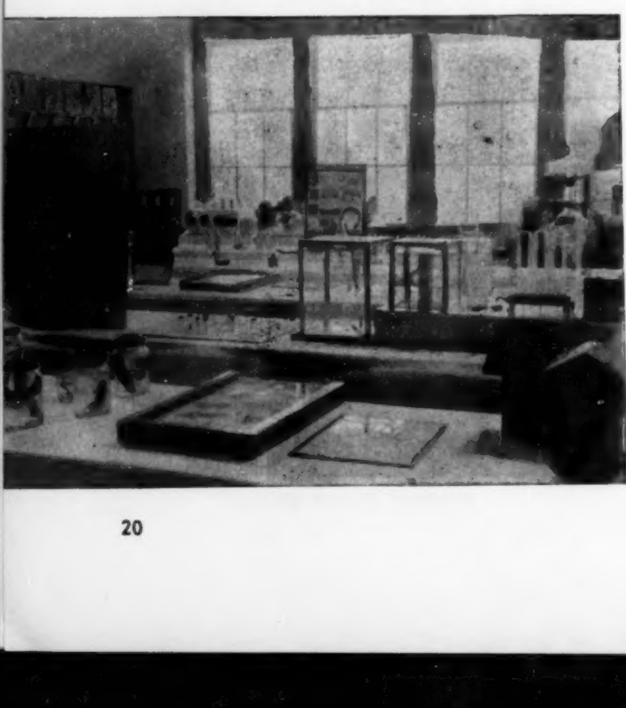
# West Virginia Junior Academy of Science

JACK NEELY *
Ansted High School Ansted, West Virginia

**For the material in this issue we are indebted to Jack Neely, formerly Senior Counselor of the West Virginia Junior Academy of Science. In the next issue will be presented the Texas Junior Academy of Science.— Editor.**

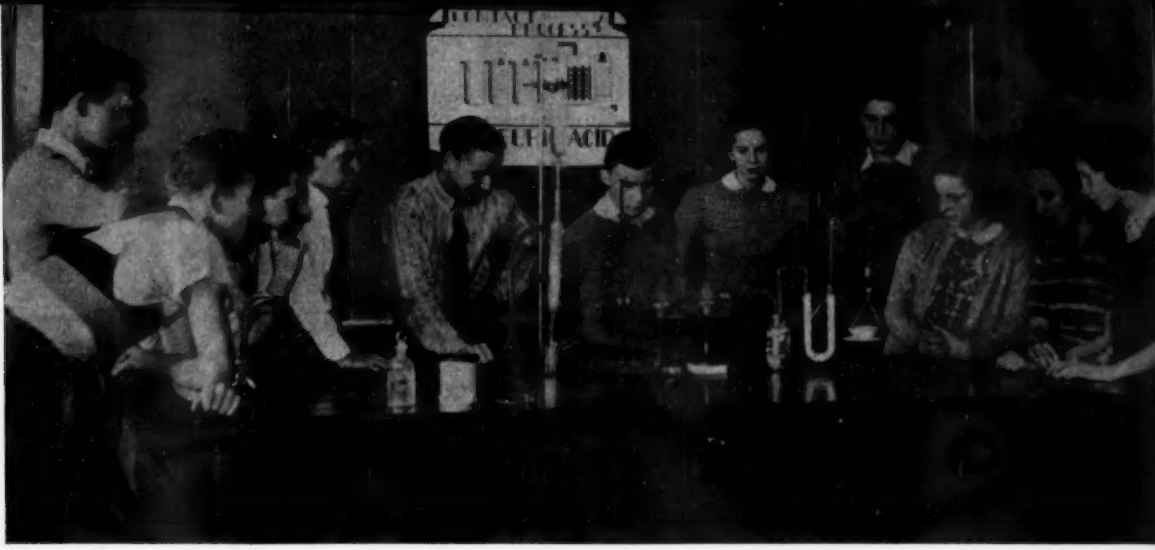
IT WAS not until the spring of 1933 that the junior academy of science movement was recognized by the scientific organizations in West Virginia. In April 1933, through the efforts of the national organization, the West Virginia Academy of Science appointed a committee headed by Professor A. B. Brooks of West Virginia University to study the junior academy movement. During the following year the committee gave the junior academy movement their utmost consideration and in April 1934 the committee's report favored the organization of a junior academy of science. At this time, the West Virginia Academy of Science appointed Professor Wallace Smith of West Virginia Institute of Technology, chairman of the committee to organize the West Virginia Junior Academy of Science. Their main objective in forming such an organization was to bring more high school science teachers in contact with the West Virginia Academy of Science as statistics showed that a very small percent of the high school science teachers were members of the West Virginia Academy of Science.

Museum of Northview Junior High School Science Club, Clarksburg, West Virginia.



THE following year was a busy one for Professor Smith. Several inquiries were sent to high schools throughout the state, and much time was spent in visiting various high schools. The returns showed that interest in the junior academy movement was at a low ebb among high school science teachers, but through his untiring efforts fourteen chapters were organized. They held their first annual convention in conjunction with the West Virginia Academy of Science at Elkins in April, 1935. At this convention the constitution was adopted and the ground work for the West Virginia Junior Academy of Science was completed. Much praise come from the West Virginia Academy of Science and visitors attending the convention to the members of the Junior Academy for a splendid program and the interest shown at their first annual convention. The out-

* Formerly senior counselor of West Virginia Junior Academy of Science.



Sulfuric acid plant demonstrated by Charleston High School Science Club

come of this convention was most encouraging to the sponsors or the organization for it established the West Virginia Junior Academy of Science.

MUCH has happened since the first convention in April, 1935. Today the West Virginia Junior Academy of Science is an organization of forty-two active chapters representing practically every section of the state. The main objective for organizing the Junior Academy has gradually shifted from that of bringing more high school science teachers in contact wiht the West Virginia Academy of Science to that of pupil interest and participation.

Today the West Virginia Junior Academy of Science recognizes four well defined objectives; they are:

(1) To create an interest in the various branches of science throughout the junior and senor high schools of the state.

(2) To recognize outstanding work among pupils, thus making their work more significant to them.

(3) To bring before the teachers and pupils the work that is being done in the various schools.

(4) To create a favorable attitude toward the sciences in our schools and communities.

The organization of the West Virginia Junior Academy of Science follows the general pattern of other state organizations. A Junior and Senior Counsellor and Editor-Treasurer is appointed by the West Virginia Academy of Science, and the other officers are elected by delegates from the various chapters upon recommendations and services rendered the organization by participating in the activities of the organization. The Senior Counsellor is head of the organization and is responsible to the Senior Academy for the activities and the annual convention of the Junior Academy.

MEMBERSHIP in the Junior Academy of Science is open to science clubs meeting the following qualifications:

(1) Sponsor must be a member of the West Virginia Academy of Science.

(2) Adopt the constitution of the West Virginia Junior Academy of Science.

(3) Pay a charter fee of one dollar and a membership fee of one dollar yearly for the entire club.

There is variety and number in the activities of the West Virginia Junior Academy of Science. Some of the activities enjoyed by the members are constructing telescopes, models, mounting birds and animals, collecting species for exhibits, experimenting with mice and pigeons to show the effects of deficiencies in vitamins, and many others that are most interesting and instructive.

All these activities and others are reported to the various chapters through the Junior News Letter which is published monthly and is the official publication for the Junior Academy of Science.

(Continued on page 23)

# Vitamin $B_1$

ERNEST SMITH
Student
Oak Hill High School
Oak Hill, West Virginia

TODAY we hear much about vitamins, but only thirty years ago vitamins were scarcely heard of and even today we do not know as much about them as we would like to know.

We define vitamins as organic compounds in small quantities in food to maintain an organism in health.

The six known vitamins today are vitamins A, B ($B_1$), C, D, E, and G ($B_2$). They have been identified and experimented with until we know a great deal about the function of each of them. These vitamins are necessary to promote many of the processes of the body, and if, for any reason, a particular vitamin is absent from the diet for a sufficient length of time some body process suffers and the body becomes affected with certain symptoms which doctors are able to recognize. The German submarine Deutchland was forced to put into an American port during the World War to stock up with fruits and green vegetables because the entire crew had scurvy. Scurvy is due to the lack of vitamin C in the diet. It was common among sailors after they had been some time at sea. In the fifteenth and sixteenth centuries, when men began to make long voyages, it was necessary to live chiefly on salt pork and hard biscuits. After this disease had become such a scourge that it was called "calamity of sailors" it occurred to someone that the restricted diet might be to blame. In 1593 an English sea captain cured his whole crew of scurvy by making them drink lemon juice. It was evident that there was some unknown something present in certain fruits, vegetables and milk that even in small quantities could make the difference of life and death. It was decided to call this unknown factor a vitamin, which in Latin means "essential to life."

I do not have time in this brief paper to discuss the effects of all the vitamins on the human body, but I will limit what I have to say to the vitamin B complex and more particularly to vitamin $B_1$ and its effects.

Vitamin B, once thought to be a single vitamin, is now known to be a whole family of vitamins. The term vitamin B is now sometimes used to mean the "B group of vitamins" or the vitamin B-complex."

Scientists at present are unable to say how many members there are in this entire family. Doubtless there are many, some of whose existence is now only suspected.

As parts of the vitamin B-complex become known, the trend is to designate each part by its chemical name. Thus vitamin $B_1$ is thiamin.

Outstanding among recent discoveries are those of Dr. C. A. Elvejem, of the University of Wisconsin. He found, in studying the B vitamins, that meat is the richest source of these important factors. The three on which the most information is available are thiamin ($B_1$), riboflavin ($B_2$), and nicotinic acid.

The findings of Dr. Elvejem and others have revolutionized the whole vitamin picture.

NOW in order to make the information more precise concerning thiamin or vitamin $B_1$, I would like to answer some of the common everyday questions concerning the vitamin.

1. Q. What is thiamin ($B_1$)?
   A. Thiamin is the pure form of what is often called vitamin $B_1$.
2. Q. What is the function of thiamin in the human body?
   A. Thiamin performs a number of functions in the body: (a) it has to do with health of the nervous

system; (b) it is essential to growth; (c) it plays an important part in maintaining the appetite; (d) it is needed for the body's utilization or metabolism and (e) it is essential to the proper functioning of the digestive system.

3. Q. How is thiamin measured?

   A. Thiamin is measured by weight of the pure crystalline substance, usually in milligrams. A milligram is 1/1000 of a gram. There are 28.4 milligrams in an ounce. Thiamin is also measured in terms of international units. One milligram of thiamin represents 333 international units.

4. Q. How much thiamin does the human body require?

   A. The minimum amount of thiamin needed to prevent thiamin deficiency is about 250 international units, or .75 milligrams daily. For buoyant, abundant health, adults need from 5 to 7 international units per pound of body weight, while children need 10 international units per pound of body weight.

5. Q. Is there any danger of eating too much thiamin.

   A. Even quite large amounts of thiamin may be eaten without harmful effects. In many individuals experimental cases, large amounts of thiamin have actually improved health. In general, a policy of moderation seems reasonable in this as in other dietary matters.

6. Q. In what foods may vitamin $B_1$ be found?

   A. Vitamin $B_1$ is present in seeds but is absent from refined cereal products like polished rice and white flour. Milk, eggs, and most fruits and vegetables also supply vitamin $B_1$.

Recent investigations show that about 50% of the United States citizens suffer generally from deficiency of some of the essential vitamins. With bread a steadily diminishing item in our diets, bakers, and millers were glad to collaborate in a solution propounded through the joint offices of the U. S. Public Health Service and the National Research Council. Most of you have noticed within the last few weeks that white bread and flour enriched with minerals and vitamins has appeared on the market. This is to replace the heavy, coarse-grained loaf of black bread which was the "staff of life" a century ago.

To show you the effects of a deficiency of vitamin $B_1$ in the diet I have three pigeons here with which I have been experimenting for three weeks. I have fed white polished rice to two of the pigeons because it does not contain the vitamin $B_1$ and scratch feed to the other one because it is all grain and contains sufficient vitamin $B_1$.

If you will observe the three pigeons you will note the symptoms of nervousness, fatigue, etc., common to organisms defiicient in vitamin $B_1$.

* This paper was written and presented to the West Virginia Junior Academy of Science May 2, 1941, by Ernest Smith, Jr., who is a Senior at Oak Hill High School, Oak Hill, West Virginia.

Mr. Smith was awarded the West Virginia State Medical Association Award for the best paper pertaining to medical science.

## JUNIOR ACADEMY

(Continued from page 21)

THE highlight of the year is the annual convention usually held at the same place and time as the West Virginia Academy of Science. There is keen competition among the various schools for awards are awarded to the best contributors by the West Virginia Academy.

The convention usually ends with the banquet and dance followed by excursions to places of interest in or near the convention city.

The eighth annual convention of the West Virginia Junior Academy of Science will be held in Buckhannon, the home of West Virginia Wesleyan College, during the last week of April.

# Examinations of Educational Value

HERBERT R. SMITH

Lakeview High School — Chicago, Illinois

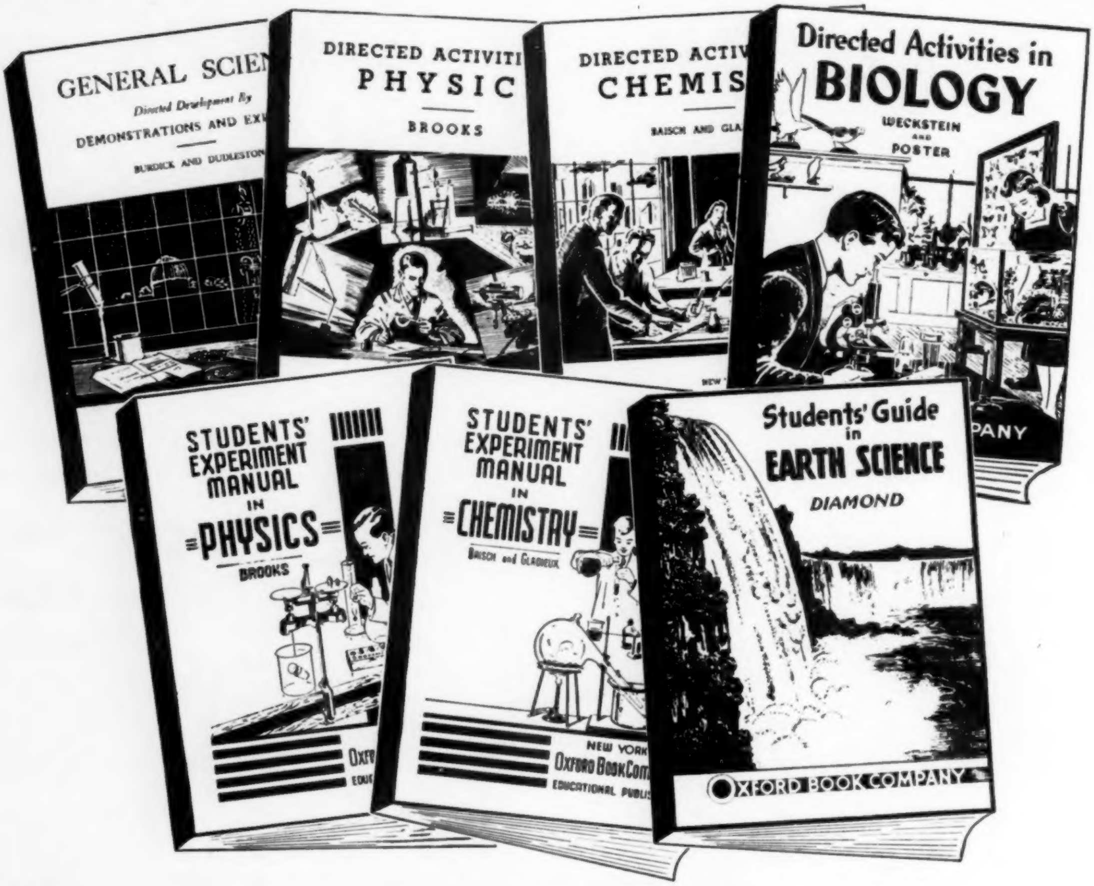
EXAMINATIONS appear to be a necessary evil in our educational methods. They are a real necessity when it is desired to make a quick sampling of a person's knowledge for a given purpose. But where a teacher has daily observation of pupil reactions to various assigned lessons, there should be no need of examinations in order to evaluate pupil effort. Any other interpretation is merely an admission of poor teaching. Examinations are justified in the class room only when they serve some sufficient educational purpose. After long experience with various forms, the incomplete sentence has given the best results. Its chief value, however, appears in the manner of its use.

The teacher of the subject considers all of the fundamental ideas that are presented to the class in a space of one or two weeks and writes out each one in succinct, sententious language. Twenty-five is a convenient number. Then he proceeds to duplicate these in some available way so that each will have his own sheet. In the duplication, however, some important word is omitted with space left for its insertion by the pupil. The definition of terms are generally used with the name of the term omitted. In other cases a selected important word or two are omitted. As soon as the class has completed the unit subject material, the sheets are issued to the class as a review test. Its purpose is to show them the need and place for further study. Ten minutes time is sufficient for a class to do its best or worst in writing in the missing words. Then the teacher at once reads the sentences giving the missing words, while each pupil scores his own paper using a different marking instrument from the one used for writing in the words. Some pupils wish to discuss values of their various words used but this is a waste of class time so it is delayed until the teacher finishes the list, then a brief time is given to pupil questions. The pupils are required to estimate the value of their words in comparison with the one given. Such sentences are marked in a different manner so that the teacher may review their judgments.

WHEN the papers are collected the class is told that this is a review test and that the real one on which their grade is based is yet to come. It will cover the same ground and they will have opportunity to make it as good as they wish it to be. The real purpose of the teacher so far is a review and outline of what is to be definitely learned. The field on which they are to be tested further is definitely marked off for their consideration. The first sheet scores are entered in the teacher's book for reference later, and another unused sheet is given to each pupil at the close of the class session so that he may later retest himself and mend his weak points by study. At some convenient time a day or so later the second test sheets given in the following manner.

In many cases the sentences are transposed with different important words omitted. Memorizing the former missing words is useless for they are now given. The whole idea must be learned and understood even when it is worded from a different angle. Opposite phases of an idea are also used. The sweetest sugar is ............... The new test has, The least sweet sugar is ............... Any sort of idea desired can be used in these sentence forms, and the emphasis can be placed where desired. The degree of difficulty can also be made as desired. There should be some easy sentences and oth-

# *Coast-to-Coast!--America's Mos*




## *Yes, and Concise Texts, and . . .*

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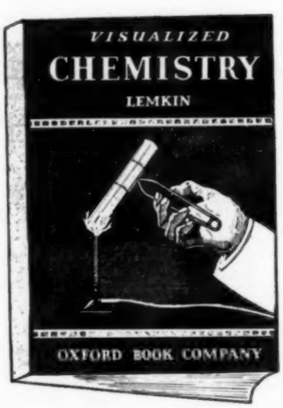


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ers not so easy. An extra one or two at the end, quite searching, will help to make a scale to measure the efforts of each varying pupil. If the extras are correctly given they count for the pupil, if missed they do not count against for the scores are computed on the basis of the number of sentences right times four gives the score. It sometimes happens that a score of over 100 is made with no ill effects.

THE cost of duplication of tests is not excessive. If stencils are made they will last at least five years with proper care. The review sheets are yellow manila seconds at 20c per ream and the final sheets are regular mimeograph paper. Most schools have the means of duplication of such tests and have clerks to assist in such work. The saving of teacher time is cosiderable and sufficient to balance the cost of this work. Once a stock of the tests are made up the teacher has no further work of writing tests during the year. Tests missed by absent pupils are easily made up by handing out the test to the pupil during some class period other than his own. After pupils learn to study the whole sentences the review test sheet can be left with the pupil for the final test and one third of the paper is saved.

The review test sheets are left with the pupils and are passed on sometimes to other classes. The only result is a better preparation for the review but this score is not included in grade. He has to meet the final test to determine his standing and care is taken to see that there are no final test sheets extant for pupils to use.

AMONG the greater advantages of this plan of testing is the powerful incentive to study for the pupil knows just what he has to meet. A thorough going-over of all the fundamentals of the course is made in each of the two tests. What other plan of testing does this? The tests come at short intervals before first impressions fade out of mind. Three or four tests are averaged to be made part of each pupils report grade. The usual final examinations come at the end of a marking period. If by this method it turns out too low there is nothing that the pupil can do about it. With the frequent tests the pupils are kept at higher working levels and if a low test is made there are others to follow in which he has a chance to retrieve his standing.

When a parent calls or is summoned to conference about a pupil's lack of effort, real evidence can be presented in the score made in the reveiw test and then after an opportunity to study, the score is not improved in the final test it is proved to the complete satisfaction of the parent that insufficient effort has been made. A file of past tests is ample insurance against unwarranted attacks by parents of pupils who have not done sufficient study. This manner of test fits well into the usual seven periods of science study per week. Two experiments per week with the single period day for class conference leave one single period for the testing and completing a cycle of study. During a ten year period of trial this testing plan has proved to be a powerful factor for education and has been aproved by practically all the pupils who have used it.

* * *

Name______________________________

**Chemistry II Review D - a**

1. The most abundant gas of the earth is ____
2. Nitrogen is obtained from air by removal of oxygen with ___________________________
3. Commercially, nitrogen is obtained by _____ of air.
4. Nitrogen is formed in the root nodules of legumes by _____________________
5. Nitrogen is colorless and _______________, does not make lime water ________________ nor support combustion.
6. Explosives are generally unstable compounds that contain much _______________
7. Ammonia is the most _______________ gas the anhydrid of _________________
8. Spirits of hartshorn was obtained by the _________________________ of deer antlers.
9. Commercially, ammonia is obtained by distillation of ______________________
10. Ammonium hydroxid is the only weak base that is ___________________________
11. Ammonia is prepared by decomposition of

(Continued on page 48)

# A Unit on Weeds

MARTHA S. ENGEL

Senior High School Madison, Wisconsin

THE plants which line the highways and byways, miraculously spring up in lawns and gardens, and creep in between stones and crevices of city pavements, may bring to some individuals, visions of summer's beauty and autumn's bright colors, while to others they signify only weariness, toil and suffering. In order that all may enjoy nature in its fullest beauty, it is necessary that certain plants, the bad actors of the kingdom, should be recognized and destroyed.

These plants, which grow where they are not wanted, we know as weeds.

I. Origin of weeds.

Some weeds are native, but the vast majority came to this country in the clothing, food, grain and other supplies of the early settlers. Some were introduced as garden plants because of their usefulness or beauty. In all cases, the plants found the new environment entirely to their liking and rapidly escaped cultivation and spread to the surrounding country side. No natural enemy checked their rapid progress. Weeds such as the dandelion, shepherd's purse, toadflax, Russian thistle and others could give interesting travelogues.

II. Adaptations of weeds.

WEEDS are plants which have remarkably adapted themselves to their environment. In general, this adaptation has taken place along two main lines; extreme vitality and reproduction.

a. Weeds are rapid growers. Their seeds germinate easily, even under unfavorable conditions. Furthermore, the seeds have unusual vitality and may lie dormant over long periods of years. Chicory seed has been known to germinate after ten years, purslane after twenty-five years, some of the mallows after 125 years. Strong runners, rhizomes and roots may develop despite adverse climatic conditions of cold, heat or drought.

b. Weeds have unusual powers of reproduction. They produce an abundance of seed. The wild carrot produces as many as 20,000 seeds on one plant alone. In addition to the amount of seed, the weed provides effective methods and mechanisms for the spread of its seeds.

III. Seed dispersal of weeds.

a. In the case of the tumble weed and Russian thistle, the whole plant is compact, light in weight, and round as to form. When the seeds are ripe itbreaks off near the ground and rolls merrily along the ground, jarring out the seeds as it bumps along. These plants may roll for many miles across the open prairie.

b. Some weeds have pappus growths on the seeds which enable them to float in the air, as for example, the dandelion and the milkweed.

c. Inflated husks or pods enable seeds like those of the peppergrass to float in streams.

d. Weeds may also use explosive mechanisms. The jewel weed seed is forcibly expelled by the tension in the pod. The yellow sorrel shoots its seeds. The vetch seed is thrown some distance by the twisting of the pod as its dries.

e. The wild oat has an interesting creeping mechanism by means of which it may pass over the ground and partially bury itself in the soil.

f. Some seeds have needles, barsb or hooks with which they may cling to passing objects and thus be carried from place to place. The Spanish needle, the burs of the burdock and of the sand bur are well known. Beggar's ticks cling to the furry coats of cattle and sheep.

g. Weeds may be spread by man in

the impure seed he plants, and in nursery stock as well as in hay and wool.

h. Weed seeds frequently have a tough seed coat which is not easily digested by animals. Hence weed seeds may be spread in manure as well as in the castings of birds. Poison ivy and deadly nightshade seeds have frequently been found in the castings of crows.

IV. Weeds may be harmful in various ways.

a. The presence of weeds produces a small yield of crop. The weed plants crowd out the useful plants.

b. Weed seeds present in seed crops reduce the value of such crops. Wheat and oats can not be sold as grade A if much cocklebur, vetch, sweet clover or garlic seed is present. In Minnesota the presence of weed seeds in seed crops costs the state one half million dollars annually.

c. Weeds harbor fungi, insects and disease bacteria. Club rot of cabbage is spread by wild mustard; rust on squirrel tail grass; the Colorado beetle lives in henbane and night shade.

d. Some weeds are poisonous and may cause irritation, pain and death. Poison ivy is poisonous to man; locoweed, corn cockle, and larkspur to forage animals. Corn cockle poisons grain. The barbed seeds of 2squirrel tail and of wild barley cause painful sores, and work into the gums of cattle, often causing a loss of teeth. Rag weed and its relation to hay fever is well known. Nettle causes irritation of the skin.

e. Weeds, such as the wild onion and garlic, may spoil dairy products.

V. Weeds may also be useful.

a. In the fallowing of the ground, weeds return valuable minerals to the soil.

b. Weeds may hold the soil and prevent erosion.

c. Some weeds are used as medicine. Foxglove yields digitalis; henbane, hyoscyamine.

d. Weeds may also be used as food. Sweet clover is used as a forage plant and man himself uses lamb's quarters, pig weed, and dandelion as spring greens.

e. Weeds, especially the clovers, are good bee plants.

f. The roots of smart weed may be used in tanning.

VI. Weeds may be eradicated by destroying top growth and preventing seed production. This may be accomplished in various ways.

b. Mowing before seeds have formed.

a. Tillage.

c. Spraying with chemicals. This has not been found to be the easiest method.

d. Burning before the weed has spread its seeds or after the weed is dried.

e. Handpicking the blossoms.

f. Clean cultivation and weeding.

g. Pasturing. Sheep especially crop vegetation close to the ground.

h. Crop rotation. Alfalfa eliminates thistles.

i. Dry salting.

j. Fallowing. Plowing must be deep enough to bury the weed seeds deep.

k. Smothering. Mulch paper may be used to destroy quack grass.

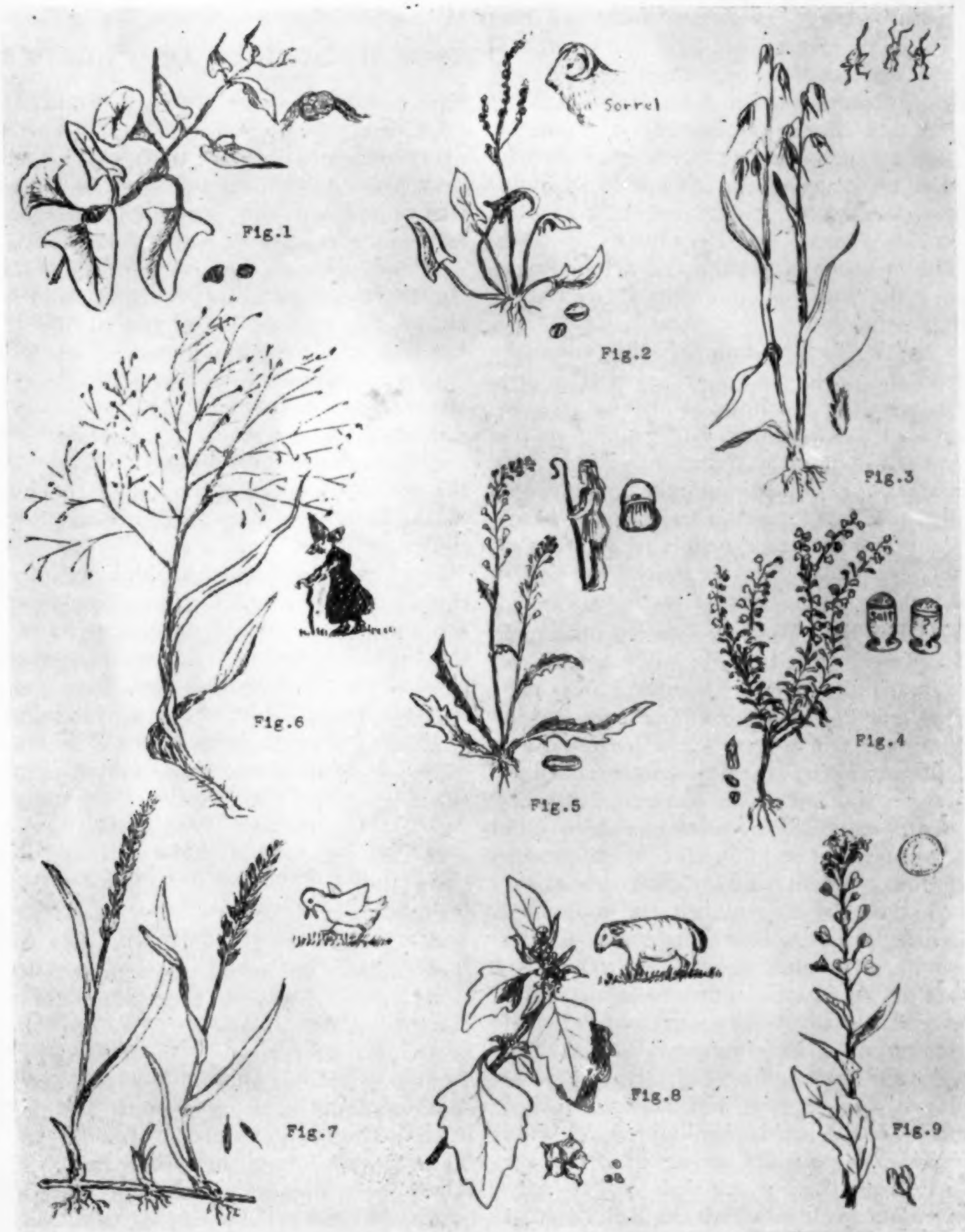
VII. Some common weeds.

a. Weeds often found in lawns. (1) Dandelion. Taraxacum officinale Weber. Naturalized from Europe and Asia. Pull by hand or spray with copper sulphate or iron sulphate. One pound to one gallon of water when the plants begin to bloom. It also injures clovers. (2) Plantain. Plantago major L. Naturalized from Europe. Pull by hand. Two plantains native to North America are P. Rugelli and P. lan-

ceolata L, rib grass or buckthorn. (3) Chickweed. Stellaria media L. An annual. Troublesome because of its spreading habit and long blooming season. Spray with iron sulphate or pull by hand. (4) Crab grass. Digitaria humifusa Pers. Blooms from June to September. Hard to mow. Keep lawn cut short. Burn or harrow. (5) Mallows. Malva rotundifolia L. Often known as Cheeses, Creeping Charlie. Pull by hand. (6) Spurge. Creeping or Spotted. Euphorbia maculata L. Pull by hand. (7) Foxtail, Green, Setaria viridis L. Yellow, Setaria glauca L. Bristly, Setaria verticillata L. Grows in tufts. Pull by hand.

b. Weeds often found in gardens. (1) Bindweed. Wild morning glory. Polygonum arvensis L. Native of Asia and Africa. Introduced to North America as a garden plant from Europe. Common also in grain fields. Summer fallow, short crop rotation, pasture hogs or chickens. Figure I. (2) Dodder. Cuscuta arvensis Beyrich. A parasite upon shrubs and herbs, especialy upon clover and alfalfa. The only method of propagation is by seeds which are frequently spread in manure. It is commonly called Strangle weed, Hellbind, Love vine or Devil's hair. (3) Sheep sorrel, Horse sorrel, Sour weed, Sour grass, or Poor Peter. Rumex acdtosella L. Spreads by underground roots and stems and by seed. Stock won't eat it. Smother. Figure II. (4) Wild oats. Avena fatua L. Grows only from seed. Use clean seed. Grow hay or pasture crops. Burn the stubble. Figure III. (5) Lady's Thumb. Polygonum Persicaria L. Introduced from Europe. Pull by hand. (6) Nimble Will. Muhlenbergia racemosa Michx. Blooms from July to September. Affords some forage when young. Rapid grower. (1) Pepper grass. Lepidium apelatum Willd. Herb has a pungent juice and the leaves taste like pepper. Seeds spread by wind or stick to clothing or fur. Somewhat poisonous. Pull by hand. Fallow. Figure IV. (8) Shepherd's purse. Capsella Bursa pastoris L. Introduced from Europe by way of Ontario. The roots harbor club rot fungus deadly to cabbage, turnips, and radishes. One plant may produce 20,000 to 30,000 seeds. Fallow, deep plow or pull by hand. A number of hybrids some of which are native to tropical America are common. Figure V. (9) Goatsbeard or oyster plant. Trapogon porrifolius. Pull by hand. (10) Purslane, Speedwell or Neckweed. Veronica peregrina L. Widely distributed in both hemispheres. The seeds many remain dormant in soil for as long as thirty years. Harbors root louse and melon louse. Pigs clear it up. (11) Old Witch Grass. Panicum capillare L. Blooming period from July to October. Mow and pull by hand. Figure VI. (12) Quack grass, Quitch grass, Dog grass, Devil's grass, Couch grass. Agropyron repens L. Introduced. Blooms August to October. Spreads by underground stems. Smother or summer fallow. Figure VII. Hard grazing while the grass is young. (13) Purslane or Pusley. Portulaca oleracea L. Fleshy prostrate annual. Naturalized from Europe. Hand pull. (14) Lamb's quarters or Goose foot. Chenopodium album L. Native of Europe. Close grazing, sheep or pigs; or fall plowing. Figure VIII. (15) Corn cockle. Agrostemma Gethago L. Purplish red flowers. Hand pull. Copper sulphate. (16) Penny cress or French weed. Thlaspi arvense L. Sometimes known also as Stinkweed or Bastard cress. Introduced from Europe. Seed pod one-half inch broad. Figure 9.

(Continued in October issue)




The above hand drawings of common weeds and the little figures by them are used in class for drilling on recognition of weeds. Each weed is represented on a separate card. Fig. 1, Wild Oats; Fig. 2, Sheep Sorrell; Fig. 3, Wild Oats; Fig. 4, Pepper Grass; Fig. 5, Shepherd's Purse; Fig. 6, Old Witch Grass; Fig. 7, Quack Grass; Fig. 8, Lamb's Quarter or Goose Foot; Fig. 9, Penny Cress or French Weed.

# Report on Teaching Symposium Botanical Society of America

THE Committee on Botanical Teaching of the Botanical Society of America held a symposium on teaching at the annual meetings of the American Association for the Advancement of Science at Dallas, Texas, on December 31, 1941. The meeting lasted for about four hours and the attendance averaged well over 100 persons.

Dr. R. T. Wareham of Ohio summarized the problems connected with objectives in the teaching of botany. He indicated the desirability of promoting the use of botanical information by the masses of non-professional people, to illustrate man's dependence upon green plants, and to teach people to distinguish between truth and superstition by applications of the scientific method.

THERE have been many ways in which different institutions have attempted to reach these goals. Dr. Otis W. Caldwell emphasized the importance of an experimental attack in determining achievement of specific educational objectives in botanical teaching. Schools which are capable of participating in such an experiment should enter into the study of the problem on a nationwide scale. But, if an experiment is to be conducted in a department, everyone in that particular department must be sympathetic to the program and must be thoroughly critical during its progress. Personal opinion must be eliminated and a valid testing program of an objective type employed. Finally, the instructors involved must be thoroughly familiar with a wide range of botanical content, or the introduction of efficient methods will be only an empty shell in which the lack of good content of instruction will defeat the success of the methods used in teaching. Specific projects which have already been tried or are under way as experiments in this field were described by Dr. Wareham of Ohio and Dr. Glenn C. Couch of Oklahoma. The combined lecture-laboratory system, according to Dr. Wareham first presents the facts; these facts are then discussed and evaluated during a laboratory conference period. Books are used for reference only because the plant itself is the main object for study and is before the student at all times. Classes are kept small and conducted informally. No formal lecture period is held. The instructor acts merely as a guide or referee, rather than as a lecturer. He answers and aims to arouse the students' interest in the plants themselves, helping students to find correct answers to their own questions.

Dr. Couch outlined the Oklahoma plan as being somewhat of a modification of the Ohio plan. Oklahoma changed from the three lecture, two 2-hour laboratory periods per week to the five 1-hour periods per week. Under the new system no formal lectures are being given. The students are divided into small sections and study the actual plants rather than books. Again the instructor acts merely as a guide and leads the students into the subject, helping them gain knowledge of the facts for themselves.

ACCORDING to Dr. Paul Weatherwax of Indiana, the usual two-semester 10-hour botany course is more than many nonscience majors need. Therefore, the five-hour, one-semester course deserves a place in many colleges. The necessary condensation is most successfully attained if the laboratory work is speeded up. Nonessentials must be eliminated and time used advantageously by careful preparation of demonstrations and class activity. The use of actual plants gives the student the opportunity to work with vivid realities, not textbook abstractions. In order to speed up the work, ready-made drawings and prepared demonstra-

tions can be used. The more logical approach in a course of this type is to study the plant as a whole first and then take up its parts and processes.

Dr. Aaron J. Sharp of Tennessee discussed the place of field work in the teaching of botany. He expressed the main objectives in this type of program as follows: "Study plants — not about them." Advantages in the use of this teaching device are: (1) Certain morphological, physiological, and ecological phenomena can be witnessed only out of doors. (2) It encourages curiosity about all natural phenomena. (3) It improves the relationship among individuals and establishes more quickly a freedom of intellectual interchange. (4) It adds to the enjoyment of the course — social and recreational values should not be ignored.

THERE are some difficulties, of course, which must be overcome before a field course can be successful. Time and transportation problems require careful advance planning, with provision for a substitute program in case of inclement weather. Large classes may be difficult to handle for work out of doors. Release of students from normal classroom may impose certain problems of discipline on the instructor. The procedure each day must be mapped out clearly on specific topics in order to insure ordered progress and good organization of factual materials.

Illustrative materials, also, have a very important place in the instruction of most courses. Dr. J. E. Sass of Ames shows the significance of using the proper materials in the teaching of botany. He suggests the use of economic species wherever possible. Up to the present time, plant materials which were used were generally chosen because af availability, tradition, habit, and influence of European texts, or because former teachers of the department used them. The scientific approach necessitates the consideration of the following points in selecting illustrative materials: (1) availability — plant should be typical of region; (2) suitability — must be good example of structure to be demonstrated; (3) familiarity — should be well known to students or at least be of interest to them in one way or another. Dr. Sass exhibited materials which are especially well adapted to certain teaching objectives.

THE introduction into the school curricula of recent trends and new research data was described by Dr. J. Fisher Stanfield of Chicago Teachers College. Developments which can be profitably incorporated into the general instruction of college botany are the subjects of hormones, witamins, vernalization, colchicine, commercial importance of plants, and new methods of plant culture. Students should be encouraged to think of plants as entities and to correlate the facts learned into a well-rounded picture of plant life and its place in human culture.

Dr. H. A. Stephens of Wisconsin discussed the necessity of improving the preparation of secondary school teachers. High school teachers must be informed of what college teachers expect of the high school graduates, so that they may better give the type of instruction desired by students who enter college. Secondary school teachers must be well informed in both science and education. The secondary school students could be better prepared for college work if the colleges cooperate more closely with public schools to coordinate and unify instruction. A medium for the exchange of professional ideas is needed in order that biologists of America may cooperate to a fuller extent. Through the American Biology Teacher information of interest and assistance to teachers can be effectively disseminated. It aims to supply up to date information and to keep all teachers current to new developments and trends as they relate to content and method in botanical instruction.

# The Cpyrous Oxide Photovoltaic Cell

SIEGFRIED S. MEYERS

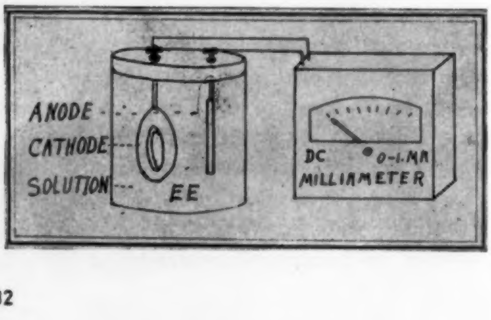
Stuyvesant High School — New York, New York

A light-sensitive cell may be made in various ways. Those which depend upon the emission of electrons upon exposure to light, are classified as the photoemissive type. The light-sensitive material consists of an alkali metal such as lithium, potassium, sodium, rhubidium, cesium, or compounds of these metals. Since these materials readily oxidize in the air, they must be enclosed in a vacuum. The output being very small, vacuum tube amplification is necessary.

The principle of photoconduction may be demonstrated with a selenium cell. This light-sensitive cell reduces its electrical resistance upon exposure to light. Due to the hygroscopic properties of selenium, its behavior is very erratic for it varies its light-to-dark resistance-ratio from time to time. Hence, it is not frequently used in practise.

THE photovoltaic light-sensitive cell develops its own voltage upon exposure to light. The type of cell commonly used in exposure meters operates on a photovoltaic basis, combined with a photoconductive behavior. A light-sensitive surface such as cuprous oxide, or selenium is sputtered with a fine, transparent film of silver, gold, or platinum. When used as such, the selenium functions as a barrier-layer between its sputtered film, and the base upon which the selenium was annealed. Simultaneously, voltage and resistance changes occur when exposed to light, which may directly drive current through a galvanometer or microammeter. Photvoltaic cells are self-generating, whereas photoemissive and photoconductive cells require an external source of power.

Photovoltaic Cell or "Electric Eye," and meter.

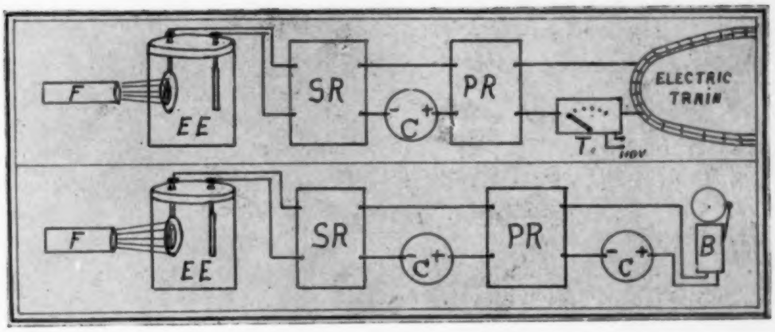


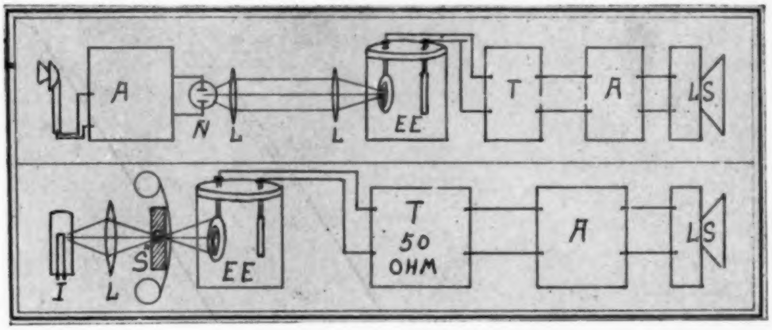

THE writer developed a liquid-type of cuprous oxide photovoltaic cell kit which is extremely simple to construct, and produces a greater output, without amplification, than can be had from any other type of cell. This cell consists of a disc of cuprous oxide as the light-sensitive element. A strip of pure lead serves as the anode. Both are immersed in a dilute solution of lead nitrate, enclosed in a jar having insulated binding posts passing through the metal cover. When exposed to the light of a 100-watt bulb, this cell develops 0.4 volts at several milliamperes, the amount of current depending directly upon the area of the cuprous oxide disc. When tested on a 35 millimeter sound picture projector, the cell successfully reproduced all frequencies that were recorded. On other tests, 5000 cycles per second was found to be the maximum practical limit, as higher frequencies resulted in a rapidly decreasing output, due to the condenser action of the cell as the frequency increased.

CUPROUS oxide may be easily prepared by heating freshly-cleaned electrolytic copper in an electric furnace for several minutes. When the copper is observed to approach melting, it must be quickly removed with tongs, and plunged into a pail of cold water. The sudden chilling results in the formation of large crystals of red cuprous oxide, covered by an undesirable surface of nonsensitive, black, cupric oxide. The cupric oxide is then removed by immersing the entire plate for several seconds in a dilute solution

Electric eye operates electric train and doorbell.

EE, electric eye; F, flash light; SR, sensitive relay (O-1MA); PR, power relay; C, a dry cell; B, bell.




Talking on a light beam with an electric eye and reproducing sound film.

I, exciter lamp; L, lens; S, slit; A, amplifier; N, neon lamp, 3 watt; T, low impedance transformer, 50 ohm; LS, loud speaker.

rinsing the oxidized plate under running water, the surface of the plate must be gently rubbed between the fingers, and rinsed again. This technique exposes the light-sensitive crystals of cuprous oxide. The plate must be dried, and a machine screw passed through its upper end for a connection. Bare, unoxidized copper must not be allowed to make contact with the electrolyte, as this combination costitutes a primary cell when used with the lead anode. This will result in a steady dark-voltage even when the cell is not exposed to light. Therefore, the copper must be painted. After the paint has dried, a strip of pure lead may be used as the anode. The cuprous oxide behaves as the cathode and both electrodes must be immersed in a 2 percent solution of lead nitrate.

THE writer constructed a large single cell whose area was sufficient to deliver 25 milliampers in direct sunlight. With reference to the accompanying sketches, the liquid type cuprous oxide photovoltaic cell was used for an exposure meter, burglar alarm, electric train control, transmission of sound on a beam of light, and for reproduction of sound film. For classroom use, the photovoltaic cell proved stimulating and educational from the viewpoint of energy transformation.

## DEPARTMENT OF SCIENCE INSTRUCTION

(Continued from page 5)

American Council of Science Teachers.

ANYONE who has not yet examined the proposed constitution for the American Council of Science Teachers may obtain one by writing to Jack Hudspeth, Box 16, Austin, Texas. Each person who studies this document is encouraged to do so from the viewpoint of a member of a regional, state, or local science organization which is a potential affiliate of the American Council. The Council will exist to serve mainly through its affiliates. The constitution has been written with the welfare of the affiliates in mind, for the Council will grow and its influence on and for science teaching will be effective only to the extent that the affiliates prosper.

# A School Project in Conservation

GEORGE J. DAVIDSON

Erasmus Hall High School — Brooklyn, New York

THE only word left in our vocabulary seems to be DEFENSE. It appears to be the guiding factor for everything we wish to buy or sell.

It depends upon our natural resources. It occurred to our teachers in the biology department that students should become aware of the resources of this bountiful country and acquainted with the ways in which they could direct their efforts so that the next generation might have enough of these natural resources. Most students have an idea that our natural resources are limitless in quantity. They do not know the many interrelated factors which combine to give us the things we need.

OUR youngsters take a walk into the country. They see streams abounding in fish, trees heavily laden with fruit, forests thick with trees and the air almost filled with birds. They have no conception of the huge amount o fwaste that results from our use of these resources. Do they know, for example, that almost 100 acres of full-grown spruce trees are needed to produce one day's edition of a large city newspaper? Since civilization demands that man be so destructive of our natural resources, it is necessary for the young of this generation to give some thought to the ways by which they may provide enough of these materials for the future generations.

Several meetings of the teachers of the biology department were held in order to determine the ways and means of putting this idea over in a school of 6000 or more students. One of the teachers, most interested in conservation, was appointed director. Then meetings were held with the department chairmen. The principal was most cooperative in seeing the idea through to fruition. Other departments began to realize how tremendously important conservation was. Everyone volunteered to participate. Club advisers were called upon to interest their club members in the idea. It began to grow by leaps and bounds.

THE writer of this article began to contact all federal, state and local agencies that could help. A list of such agencies appears at the end of this article. Everyone was quick to respond to my request for materials. Pamphlets in large bundles began to come in. Large photographs of appropriate material, such as forests, erosion, Civilian Conservation Corp, health charts, came to my desk. The Department of Health sent large cases depicting what they were doing to conserve health. Wildlife associations and Audubon Societies sent excellent material.

THE art department had the students working on posters. A statement from the governor of the state was illumined on a large poster and exhibited in the entrance of the building. A series of motion pictures was arranged. Such pictures were shown during the day in large study halls and after school in the auditorium. Every class was given a program of events. The school newspaper carried front page items about the Conservation Fair. Below will be found a copy of a printed poster which was placed in every conspicuous spot and on every classroom bulletin board.

* * *

**CONSERVATION FAIR**

Erasmus Hall High School

**"OUR COUNTRY OF TOMORROW"**

MAY 7 to 15, 1941.

Exhibits by All Clubs

Lectures — Movies — Slides

Poster Contest — Essay Contest

SIDE-SHOWS

● Come and learn what you, as loyal Americans, can do to make this country richer in resources. Find out how you can participate in saving our rapidly disappearing wild animal and plant life. **Everything Is Free! . . . No Charge for Admission. Don't Miss This!**

* * *

There were interesting lectures by prominent people. The Botanic Garden provided two lecturers. Various conservation agencies provided speakers. The Dramatic club presented an appropriate play. Several field trips were arranged.

EVERY exhibit case in the building was assigned to a specific department or club. Very fine original exhibits were placed in these cases. Every bit of wall space was used to shout out . . . CONSERVATION! No student, no matter how apathetic, could have come to school that week without being better informed about his country vast stores of resources. No student could have left for home on any day of the Fair without having a greater knowledge of the hundreds of governmental agencies that are organized to control our resources and improve the health and welfare of its citizens. I am sure that each one now harbors a keen desire to help our country over this most critical period in its history.

The following were the main divisions of the Conservation Fair:

Human Conservation.

Sponsored by the health and home economics departments. Exhibits about health, posture, Red Cross, accidents, safety, dietetics, life saving and sports were all produced by these departments.

Wildlife Conservation.

Assigned to biology and science departments. Exhibits about birds, fish, other wild animals.

Our National Parks.

Sanctuaries, parks, wild flowers, forestry.

Soil Conservation.

The C.C.C., Departments of Agriculture of state and nation, Soil Conservation Service of state and nation.

Property Conservation.

Aimed at preventing vandalism. Attempt to make students conscious of their responsibility in caring for public property.

IN GENERAL, the above is a summary of the Conservation Fair as given at this school. I must say that I received 100% cooperation from every teacher and agency. It is advisable to begin contacting agencies at least two months in advance of opening date. I suggest the following agencies as most willing to cooperate.

Agencies:

Your local, state and national health departments.

Civilian Conservation Corps, Washington, D.C.

State and national departments of agriculture.

Soil Conservations Service, Dept. of Agriculture, Washington, D. C.

National Wildlife Federation, Washington, D. C.

State and national departments of education.

Conservation department in your own state capitol.

U. S. Biologic Survey, Washington,

Metropolitan Life Insurance Company . . . many pamphlets and films.

American Nature Association, Washington, D.C.

Emergency Conservation Committee, 734 Lexington Ave., New York City.

National Association of Audubon Societies, New York City.

There are many other agencies which you will think of as you begin to plan your Fair. Contact your local Botanic Garden, Zoological Park and Museums.

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## NATIONAL SCIENCE COMMITTEE

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teachers. Certainly none of them are the least bit interested in doing anything that would bring injury or harm to science teaching. We are interested in more science teaching — not less. Our main and consuming interest has been the improvement and expansion of science teaching. We may find later that the recommendations made in the reports will not improve science teaching, and, if such is the case, then we can say we misinterpreted the reactions, opinions, and suggestions of thousands of teachers. The mistake is ours, not the teachers!

ALL of the reports are published under the signatures of all members of the Committee. There are no minority or dissenting reports. However, we do hope there will be many dissenting opinions when the reports are read and teachers have had an opportunity to react. Please do not assume that all members of the Committee agree with all parts of the reports. In saying they agreed to sign them, the members believed the reports were good enough to be published and good enough to deserve the consideration of science teachers. They do not expect unanimous agreement. That would be dangerous.

The Committee reports do not contain any specifics for courses of study, methods of teaching, or modes of organization. We know many teachers wanted us to furnish the specifics for everything. We heard constantly — "Give us something that will work in the classroom."

The report on Procedures and Materials will give illustrations of how some teachers do the things we are suggesting. These illustrations will help to give meaning to the recommendations and are not intended to be specifics. They will be suggestive, not prescriptive.

THE Committee has attempted to bring its reports up to the point where others will produce materials to be used in the classroom. This will mean the new and more purposeful content that is needed in many areas, new or revised textbooks, new points of view with some changes in methods of teaching, and a place to teach science which is as broad as the community itself.

Teachers will, no doubt, be surprised to learn that the reports say very little about what we are doing in science at the present time. They neither condemn nor approve what is being done now, with the possible exception of the one criticism — "Our science teaching has not been as functional as it might have been." You will all agree with that criticism, I am sure. The reports do not recommend that the present courses of study or subject matter be discarded; they do not suggest new courses, neither do they condemn the core curriculum, new organization of content, an entirely new selection of content, easy courses, or anything new that is being offered.

AND, further, the reports do not mention or condemn any other subject matter areas. You will wonder why specific recommendations are not included. The answer is easy — the Committee refuses to tell you what the best method is for teaching science on a functional basis when it does not know what it *is* itself. They would be unscientific if they said they did.

However, the Committee has, I think, some very sound and practical suggestions for the functional teaching of science. The reports on "Science Teaching for Better Living" give the Committee's point of view on functional teaching and the areas in which the outcomes of functional teaching can best be derived. The report on "Redirecting Science Teaching in the Light of Social-Personal Needs" lists many specific needs or outcomes in the areas suggested in the first report. The report on "The Education of the Science Teacher" suggests a program for educating the new science teacher to meet the additional areas of preparation which the future will demand.

APPROXIMATELY 85 per cent of science teachers do not teach controversial issues largely created by science. Their main reason is, they say — "We were not prepared to do it." Approximately the same number say — "Pupils would be better off if these issues were taught in class than they are by using the material which is taught now." The teachers are not doing what they think should be done because they were not trained or educated to do it.

One illustration will help to make clear what I have said about the reports. We teach some facts and principles about water in all of our science classes. We make some applications and talk about water systems, water pressure, hydraulic appliances, and how bacteria are spread by water. So far, so good. This is necessary. This is what we have been doing. There is no criticism of this at all.

But, let us ask ourselves this question: How has what we have taught affected or changed the thinking, the action, and the behavior of the boys and girls who are doing the learning? Will they, because of what they have learned, drink more water, always insist on drinking pure water, clean up mud holes and mosquito breeding places in their communities, keep themselves and their clothing clean, take part in activities which will protect the purity of the community's water supply, refrain from swimming in the water reservoir, repair a faucet if it leaks, vote intelligently on measures involving the conservation of our water resources, not go into deep water until they have learned to swim, and many other activities which may be mentioned?

WHEN we can get boys and girls to act and do things, and make it a part of their everyday living because of what they learned in science, then science teaching has become functional. Here is

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## VICTORY GARDEN

(Continued from page 11)

aged, it will supply a family of three with many fresh vegetables from spring through fall. It should yield two and even three crops. We recommend eight vegetables selected because of their ease of culture and small space requirements. The list includes radishes, onions (from sets or plants), leaf lettuce, carrots, beets, and certain leafy vegetables. The term "student experimental" refers only to the fact that one person with a minimum amount of time is needed to work it.

THE MEDIUM garden plot or the Family "Victory Garden" is any area from the preceding mentioned size up to the size of an average city lot. It should furnish a family of five with vegetables for one hundred and twenty-five days or more and even some for canning and storage. With this sized garden we recommend two dozen vegetables including the preceding list with the addition of cabbage, peas and others.

The largest sized plot will receive such vegetables as will be found in truck gardens, including corn, pumpkins, melons, squash, and others. Potatoes are mentioned, but reservedly, because most Chicago soil is not suitable for potato culture. These vegetables are selected because they cover large areas, or are warm summer crops, and not suited to intensive gardening practices of two or three crops. The total Lane vegetable list exclusive of herbs is thirty-three as compared with about forty (including herbs) recommended by the Greater Chicago Metropolitan Area Victory Garden group. The two lists were arrived at independently of each other and prior to the time the author was appointed lecturer for the Chicago metropolitan group. The entire lecture series sponsored by the group is under the direction of the Chicago Park District staff and a few invited guest lecturers.

**Making Your Garden Program a Reality.** The success of the preceding apparent theorizing depends upon a good school growing room, or auxiliary equipment, as a substitute. If you have a separate greenhouse, excellent; if a bay windowed growing spot, fine; if none of these, but still a place on the campus for a hotbed or cold fram, this is still one hundred per cent satisfactory for the initiation of your community garden project. Hot beds or cold frames are desirable even with these other growing areas. In either case they both stand to be of service to you and your garden plans. Procure a good garden book and study how to grow seeds, and how to set up hot beds and cold frames. I will briefly describe such a unit to aid you in your thinking.

**Cold Frame and Hot Bed.** A cold frame is simply a bottomless wooden box covered with glazed window sash. A cold frame permits one to start seeds a few weeks earlier than would be the case otherwise. The window sash will determine the size of the box, but it should fit tightly, yet be movable for ventilating, watering, and plant care. If seeds are planted in the ground, the soil should be fertile and suitable for seed germination.

THE HOT BED is the same as a cold frame but with the addition of some method of supplying artificial heat to the bottom of the soil. It is used to start plants six weeks or more in advance of the seeding time. It should be protected but receive the full rays of the sun. If it is at the base of a wall with a southern exposure, that is satisfactory. It should slope toward the south with a fall of one inch to the foot. In other words, if the sash is five feet long the north will be five inches higher than the south end.

The hot bed is a deep trench with sufficient drainage. There is a layer of two feet of fresh horse manure on top of this drainage (perhaps cinders, sand or crushed stone). On top of the manure

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## PROJECTS IN BIOLOGY

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### Project II.

WATCHING a Plant Grow. Figure I. This is a "pupil-built -at-home" device to determine the rate of growth of a plant. The support is made the same as in Project I. Figure IV shows in detail the bearing which holds the spool and pointer arm. Two ¼ by 1-inch stove bolts are supported by two 1½-inch angle irons. These bolts may be fitted in drilled and tapped holes through the angles, or may be fastened through a ¼-inch hole with a nut on each side of the iron to hold the bolt in place and provide for adjustment. The spool is fastened to a nail, the ends of which have been cut and pointed with a file. These ends fit into the ends of the stove bolts, which have been drilled with the point of a drill as shown. This arrangement produces very little friction.

The pointer arm, fastened to the spool by two small screws, is made of a thin strip of metal. The boy used a piece of metal tape, such as is used to tie around boxes of hardware. A ¼ x 6-inch carriage bolt was filed flat on the head end and soldered to the metal strip to act as a counterweight. A heavy thread is fastened around the spool, one end of which is attached to the plant; the other end has a light iron washer for a weight. In this project the radius of the spool is one-half inch, the pointer is twenty inches long, giving a multiplying power of 40. Any ratio might be used.

THIS pupil, be careful experimentation, calibrated this apparatus so it would read directly the growth of the plant. The calibrations are on a card fastened to a piece of ply wood. The whole equipment can be adjusted as shown in Figure IV.

List of materials needed to make this project:

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## DEVELOPMENTS IN PETROLEUM

(Continued from page 4)

### Products Derived From Propylene

IN 1920 appeared the first account of the manufacture of isopropyl alcohol from propylene. The information was in the form of an article by Ellis in that year. For many industrial purposes, this alcohol competes effectively with ethyl alcohol. It has been announced recently that an aviation fuel of 100 octane rating can be produced from isopropyl ether, blended with selected gasoline stocks and with 1 cubic centimeter of ethyl fluid per gallon added. The volume production of isopropyl ether no doubt will show a rapid increase.

It is possible also to catalytically dehydrogenate isopropyl alcohol and obtain acetone. The acetone can then be converted into ketene and from the latter may be derived such products as acetic anhydride, acetoacetanilide, acetoacetic methyl and ethyl esters. At present, acetic anhydride occupies an important position as a synthetic organic chemical and is made chiefly from acetylene through ethylidene diacetate, from acetic acid by thermal decomposition, and from ketene. It is estimated that the annual consumption of acetic anhydride in the United States probably exceeds 100,000,000 lbs.

THE FOREGOING does not attempt to include all the products obtainable from petroleum or natural gas. Many others could be cited such as oxidized paraffins, high pressure lubricants, antioxidants, products for improving diesel oils, solvents for refining lubricating oils by solvent extraction and many similar products. Most of the progress to date has been with the utilization of the more simple hydrocarbons, which development has been especially favored by relatively

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## PHYSICS CLUB

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1. Neon signs — the local service man will make a straight neon tube, one and one-half feet long for something like a dollar and a half. A model T spark coil and battery will operate the tube.
2. A bank of lights to show voltage drop. Four or five 110 volt bulbs attached to a five-foot board. Connect with nichrome wire. The wire should be bent back and forth so as to use as much as possible.
3. A railroad track mounted on a bicycle wheel to show the law of interaction.
4. A hand-made stroboscope. Mount on a board with the neon tube in item 1 as the light, together with model T spark coil. A plain wooden wheel, eight inch diameter, cut from a board is mounted on a revolving shaft. The wheel serves the double purpose of backing up the stroboscopic pattern and carrying the revolving contact. The contact is simply a wire from one hub of the wheel to the other across the rim of the wheel. This contact hits a piece of clock spring to cause the intermittent flashes of the neon tube. A large white pattern on a black background is best. This device may be turned with a crank or motor. In a dark room this stroboscope compares favorably with the high priced supply variety. The whole should be mounted on a board. Total cost about one dollar.
5. A circular row of Christmas tree lights wired and mounted on a wheel. This wheel may also be cut from a board. The wheel should have about a fourteen inch diameter and may be attached to the same shaft used in item 4. A copper strip is fastened around the rim of the wheel like a wagon tire. Again a clock spring placed against the copper rim makes the sliding contact to light the bulbs. When the lighted bulbs are rotated the effect is a pinwheel of white light. When brought to rest the effect of all the colors of the rainbow is startling. For best effect the wheel should be rotating before shown to the class. Cost about fifty cents.
6. A blower to furnish a sufficient current of air to support ping pong balls or possibly wooden bals about the size of ping pong bals. An old worn out vacuum cleaner but with a good motor will do the trick. Almost any dealer will donate the old cleaner. A fitting must be made for the nozzle. The fitting should be tapered down to about one fourth inch. It may be made from tagboard. If a metal one is desired the services of a tinsmith may be required. This apparatus demonstrates Bournelli's principle of course but Bob Feller of the Cleveland Indians is considered a master of the application of this principle. The pupils are more interested in Feller than Bournelli, so we will take our physics from Feller in this instance. The jet of air will find many other uses, such as demonstrating the siren, drying glassware, etc.
7. A coffee can with spark plug soldered in the side with model T coil and battery attached to show how the power stroke takes place in the cylinder of a gasoline engine. To give the demonstration pour a tablespoon of gasolin into the can. Put the cover on tight. Wait a minute. Then throw the switch to the ignition system. If nothing happens, wait and try again. If there are still no results throw a lighted match into the can and let the gas burn. When the burning has stopped pour in another spoonful of gas and throw the switch.
8. A coffee can with one hole in the cover and two other holes opposite each other in the side of the can near the bottom. The purpose is to show that a mixture of illuminating gas and air is explosive. In one of the holes near the bottom of the can insert a gas hose which has been attached to the gas supply. Turn on the gas. When

the can has been filled, light the gas as it issues from the hole in the cover. A high luminous flame will result. Turn off the gas. The flame will grow smaller. It will also become less luminous until, when the flame is very small and quite nonluminous, the explosion occurs. The cover will hit the ceiling.

If the demonstrator wishes to surprise more completely, he should talk about luminous and nonluminous flames as the class watches the changing flame. By doing this the attention of the class is kept on the flame and they do not expect an explosion.

THE apparatus described above is enough to give a clear idea of what can be done by a physics club in achieving a very definite, worth-while objective. In the particular case of the subject of physics it may well be thought of as an invaluable help to both teacher and pupils. Where shop physics is required in the mechanic arts course, a special problem is presented to the teached. Textbook writers and other sources seem to have left the problem unnoticed. The teacher, however, must take notice. He must provide material, apparatus, and methods to handle the situation. It is here that the physics club may achieve the most in its role as an aid to teaching.

When the school is of considerable size it is often quite worthwhile to put on a science fair annually. When this is the case. the objective of such a physics club as has been described above can be carried over to this event.

THE idea of the physics club becoming affiliated with a nation-wide organization of science clubs is well worth consideration. Such an affiliation is quite likely to lend something of dignity and distinction to the local organization and to the individual members. There are also certain definite benefits to be derived from membership in the larger organization. A club pin seems to have a very stimulating effect. It would seem to be good policy for both the local club

## PHYSICS CLUB

and the larger organization if such larger unit would provide each individual member inexpensive but proper insignia. It is quite probable that such insignia will increase membership, especially if the insignia is furnished without additional cost other than the membership fee.

## VICTORY GARDEN

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is placed six inches of potting soil, a rich porous absorbent loam. The soil could be a mixture of two parts loam, one of humus, one of coarse sand and one half peat moss or leaf mold. The fermentation of the fresh horse manure furnishes bottom heat for the soil. Check with a thermometer and do not start plants until the temperature falls below ninety degrees or you will kill your seedlings. Seed flats, potted plants and others may be grown in this area. Ventilate during the day and close at night. In severe weather the glass over the hotbed and the other exposed area will have to be protected with a covering of mats, burlap or straw. Care for your plants in the hot bed the same as for any other growing area. Before setting out your plants they must be hardened by reducing the growing temperature to near the outside. This is accomplished by shifting them to a cold frame or increasing the ventilation.

SINCE December seventh the United States Department of Agriculture has requested there be a million and a half more gardens this next year. You as a science teacher should sponsor your quota of these gardens immediately. If you can induce a novice to plan and successfully execute a vegetable garden to his satisfaction, or if you can aid the experienced gardener, you will have performed a real service.

## DEVELOPMENTS IN PETROLEUM

(Continued from page 41)

low priced raw materials and relatively simple chemistry.


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## AFFILIATING WITH NAT'L ASSOCIATION

(Continued from page 6)

the improvement of science instruction. The work of the National Science Committee of the Division of Science Instruction of the National Educational Association is a case in point. No end of effort has been made and a considerable sum of money has been spent to acquaint teachers with the work of the committee and to get cooperation. The success has been quite marked. But how much more simple the whole national program would have been if all local groups had been affiliated with the national association and had been kept informed of the work through a service publication. More effective teamwork, more participation, greater interest, and a wider acquaintance with results among active teachers would have been the result.

THE matter of journal service, already mentioned, is another advantage coming through affiliation that cannot be over-emphasized. The larger group has the greater strength to produce a satisfactory journal service and can command greater support among advertisers. This it accomplishes both with a saving to commercial firms and with greater service to the interested associations.

## SEMI-MICRO METHODS

(Continued from page 17)

Test tubes and beakers can be heated but spot plates and papers cannot.

**Experiment: Chemical Properties**

Apparatus: Spot plate, dropper.

Materials: Zinc shavings, copper wire, calcium carbide, sulfuric acid.

In observing the chemical properties of a material, the ones which usually receive first attention are those which are easiest to observe. This is a long list of chemical properties which can be worked out from any material. In this experiment we will examine only a few.

**Burning.** Hold a few strands of zinc turnings in the forceps. Place in the flame of a Bunsen burner. Does the zinc burn? Try some fine copper wire. Does the copper burn in air?

**Action with water.** Put a little water in each of three holes of a spot plate. Into one place a very little zinc and into another a very little copper. Are zinc and copper alike in their reaction with water? Try a very small piece of calcium carbide in the third spot. Does it have any action with water?

**Action with acid.** Put three drops of water into each of three clean spots of a dry plate. Add one drop of sulfuric acid to each. To one spot add zinc, copper to the next, and calcium carbide to the third. Do these materials act the same in water and in acid?

List the chemical properties observed.

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## PROJECTS IN BIOLOGY

(Continued from page 40)

1 piece 3 in. x 16 in. upright with ¼ in. slot cut in.
1 piece 12 x 12 in. base — apple box end.
1 piece 24 x 36 in. ⅜ -in. plywood to hold cardboard.
1 30 in. x 40 in. cardboard.
3 ¼ x 1-in. stove bolts.
2 1½-in. angle irons.
1 ¼ x 6-in. carriage bolt for counterweight.
1 4-in. angle iron to support upright on base.
1 2-in. nail sharpened in both ends.
1 1-in. spool.
2 ¼-in. wing nuts.
1 ⅜-in. x 20-in. light metal strip for pointer.

THE cost including the plywood is less than $1.00. The project, with a growing plant attached, will created a sustaining interest in the biology classroom. The fact that such delicate instrument can be made by a pupil seems to the other members of the class an outstanding accomplishment. Many observations can be made to answer such questions as these: During what part of the day does a plant grow most rapidly? The least? How much does a plant grow in one hour?

Ingenious pupils of biology undoubtedly can improve as well as vary this subject to suit their individual wishes. They can be made to feel that they are making a worthwhile contribution.

## NATIONAL SCIENCE COMMITTEE

(Continued from page 37)

where the Committee begins to make recommendations. How can we go on from what we have been doing, or where we are, to where we ought to be — that is make science a vital, living, and necessary part of the everyday life of each boy and girl, as well as the community in which they live?

Can science be taught in a functional way by beginning with subject matter as we have been doing, or must we begin with specific outcomes and then select the subject matter best suited to teach these outcomes?

The Committee does not attempt to answer the question. It hopes both procedures will be used. Certainly, open-minded science teachers will not throw up their hands in horror if some persons attempt to teach science by using desirable outcomes as the beginning point.

WILL the Committee's reports help to implement and transplant into classroom practice the challenging issues raised in the reports of the Educational Policies Commission? The Committee believes they will. And, still further, the Committee hopes its reports will help to give science a more prominent and rightful place in the curriculum of the schools in the future. You may rest assured the Committee hopes its reports will give science a much more prominent place than do the reports of the Educational Policies Commission.

## PROJECTS IN CONSERVATION

(Continued from page 35)

THERE is a very small expense involved in conducting this Fair. \$25 can amply cover the most ambitious project. It can be done with much less. You must provide postage and transportation costs for films. Naturally films from a great distance will cost 35c to 50c per set of reels. Loan charges are made on some sound films. Some concern may be willing to loan a sound machine to the school if you have none.

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## BOOK SHELF

**Studies and Activities in Biology. Chapin W. Day, Caldwell High School, Caldwell, New Jersey and Margaret Ritchie, Saint Agnes School, Albany, New York. Edited by John W. Ritchie. World Book Company, 1942. 218 pages. $.80 net.**

Studies and Activities in Biology is arranged as a laboratory guide. The authors have attempted so far as possible to organize and present the work so as to direct the attention of the student towards an understanding of the principles of science involved in this field. For example, in the unit on methods and problems of reproduction the problems presented are: "What Method of Reproduction Is Found Among the Simplest Green Plants? What Asexual Methods of Reproduction Occur in Land Plants? What Adaptations for Sexual Reproduction Are Comomn in Seed Plants?"

The pages are mostly made up in a two-column style. All illustrations are hand drawings. There is an abundance of them. Review questions and applications are included with each unit.

## CIVILIAN DEFENSE LIBRARY

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well. But the reader will feel that much remains unsaid. The insidious penetration, during past years, of German interests in American industry, through patent control and cartel arrangements, resulting in a crucial inadequacy of basic essential materials, could have provided appropriate material for an additional chapter. An outline of this problem, written by Norman M. Littell, United States Attorney General, appears in the March 9 and 16 issues of "In Fact" (In Fact, Inc., 19 University Pl., N.Y.C. Both issues 10c).

Films on civilian defense are making their appearance. These will prove very effective in building morale as well as in giving specific instructions for emergency action. "Air Raid Warden" (Brandon Films, N.Y.C. 1 reel, 16 mm, sound) shows the air raid warden going about his multifarious duties with efficiency, calm and self confidence. "Fighting the Fire Bomb" (Transfilms, N. Y. C.) is an excellent presentation of methods of handling the magnesium incendiary bomb.

## PROJECTS IN CONSERVATION

(Continued from page 47)

The benefits to be derived from a fair need not here be dwelt upon. Anyone can visualize the interest that will be stirred up in all classes. The French and Sanish classes will have essays on Conservation written in foreign language. The English department may have a contest for the best essay on "What Conservation Should Mean to Me." A book could be donated as a prize. The history and civics classes will find much material to occupy several periods. The science classes will have enough material for very interesting lessons on the saving of our mineral resources, our wildlife, our chemical deposits. The writer hopes that others will attempt this valuable project. Also he will be pleased to hear from other schools that have tried this out with new and novel procedures.

## EXAMINATIONS OF VALUE

(Continued from page 25)

### Chemistry II Test D - b

1. The percent of nitrogen in the atmosphere is --------------
2. Pure nitrogen is obtained by decomposition of heated -------------- --------------
3. Nitrogen must be forced into combination by much --------------
4. Nitrogen compounds are formed by bacteria in root nodules of --------------
5. Nitrogen is ------------- and odorless, does not support --------------, nor make lime water milky.
6. Explosives are generally ------------ compounds that contain much energy.
7. The most soluble gas is ------------, the -------------- of $NH_4OH$.
8. The distillation of deer antlers makes ---- ---------------- called spirits of hartshorn.
9. Distillation of soft coal is the ------------ preparation of --------------
10. Ammonium hydroxid is the only ---------- ---------- that is soluble.
11. Decomposition of an ammonium salt heated with a strong -------------- is the preparation of --------------